Classroom Computer News

SEPTEMBER-OCTOBER, 1980 VOLUME 1, NO. 1

The educational computing industry is growing rapidly, but who has control?

The Computer Industry and Education: the Issue of Responsibility

by Phyllis Caputo

Computer manufacturers are zeroing in on the educational computing market. Executives of Texas Instruments, in a recent stockholders' meeting, singled out education as one of the four top markets for new Texas Instruments products. Charles Phillips, Radio Shack's senior vice president, says that "Radio Shack had determined that in the eighties, education will be our second largest market, second only to small business." Similarly, Commodore Business Machines estimates that 25-40 percent of their market will be education in 1981.

Present and projected sales figures for the education market alone reveal the reason for this increased interest. Of the 16,112 public school systems in America, 30 percent have computers for instructional use. In the next four years, this could increase to 60 percent of all schools. International Data Corporation, an independent market research and consulting firm for the information processing field, predicts that sales of microcomputers will increase five-fold in the next few years, reaching shipments of 1.2 million in 1983. School sales for that year are expected to be 105,000 units — a projected $146 million, up from $46 million in 1979.

These projections cross-check with assessments by industry officials who report a near doubling of growth each year. Industry spokespeople, while unwilling to give exact sales figures and dollar sales projections, do offer impressive ball park figures. Control Data (distributor of the PLATO computer learning system), for example, reported 1979 sales double those of 1978; 1980 promises

Please turn to pg. 6

MICRONEWS

- Gulf Texas Multiregional Processing Center has recommended Bell & Howell microcomputers for region's 110 school districts. Officials expect recommendation to result in purchase of 600 systems during 1980-1981. It's the largest single regional purchase of microcomputers yet, according to Bell & Howell. The center serves 640,000 students, including the Houston Independent School District.

- Lesley College of Cambridge, Massachusetts, has developed a graduate program in computers and education. The program, which leads to a master's degree and a teaching certificate, includes courses in hardware, programming and curriculum development.

- The University of Minnesota and Control Data Corporation have announced plans for a Midwest regional center for microelectronics and information systems. Control Data contributed $2 million toward the center, one of the largest grants ever received by the university.

- Apple Computer Inc. plans soon to file with the Securities and Exchange Commission a public offering of common stock. Apple, started in a Palo Alto garage in 1977, is said to have annual sales of about $175 million. The company expects to raise more than $20 million.

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FORUM

The Supertanker and the Missile

by Lloyd R. Prentice

Five years is not long in the perspective of American education.

But five years may as well be a century in the field of computer technology.

Over the past five years, American education has been buffeted by declining enrollment, rising costs, ideological conflict, plummeting professional morale and a rising tide of criticism from parents, politicians and the news media.

Over the same period the computer field has exploded with ideas and products that are likely to change society more fundamentally than did the introduction of the automobile a near century ago. Says writer James Fallows, "If the aircraft industry had progressed at the same rate . . . the Concorde would now hold 10,000 passengers and travel at 60,000 miles per hour, and a ticket would cost one cent."

Of course comparing innovation in computers with progress in the classroom is like comparing cabbages with kings. The theoretical sources of the computer field are tractable sciences — mathematics and physics — and the nurturing culture is free enterprise; the roots of education are in psychology and sociology and the topsoil is politics — a flinty medium at best.

Rates of Progress

Nevertheless, a comparison of the *rate* of progress in the two fields is quite germane because our classrooms will surely feel the howling winds of change whipped up by brainstorms in the computer industry. Indeed, science fiction writer Arthur C. Clarke sees education and small computers coming together like two hemispheres of plutonium in a nuclear device, leading to an explosion of educational and social progress. But others are not so sure — they point to teaching machines and instructional television. They say that the shiny computer of today will attract dust in the closet tomorrow.

Which prognostication is correct? Probably neither. Schools are conservative by their very nature. The rhythms of education are entrained to both the human developmental cycle and the political cycles of the electoral process. Nevertheless, computers are already important learning tools in our schools, and judging from the enthusiasm of the youngsters, they have a great deal to offer. Yet the verdict is still out on the long term implications. It all hinges on how teachers and administrators work computers into the curricula.

The Supertanker and the Missile

Rate of change. American education moves like a supertanker wallowing in turbulent water. Computer technology moves like a Saturn rocket tearing itself out of earth's gravity. American education needs to pull its bow into the swells and make way against the broaching currents. Computers could help provide the momentum, but how does one harness a missile?

This is what *Classroom Computer News* is all about — narrowing the gap between educators and computer specialists. It's not about machines, but about people. It's not about technology, but about new ideas to help youngsters prepare for the future. We're proud to share with you this first issue. But we humbly ask your suggestions and help in the form of letters, programs and articles to make future issues even better. We'd like to see *Classroom Computer News* evolve as dramatically as has the technology for making marvelous machines out of silicon crystal. With your help, we know it will.

American education needs to make way against the broaching currents. Computers could help provide the momentum, but how does one harness a missile?

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More Questions than Answers

In more and more school systems, school boards and Uncle Sam are giving Apples to teachers. But the Apples, as well as the PETs, the TRS-80s and other microcomputers, raise many questions for educators. How should children work with the new machines? How can media people keep the school's new micros out of storage closets? What is good educational software? Where can teachers get it? Can teachers write their own?

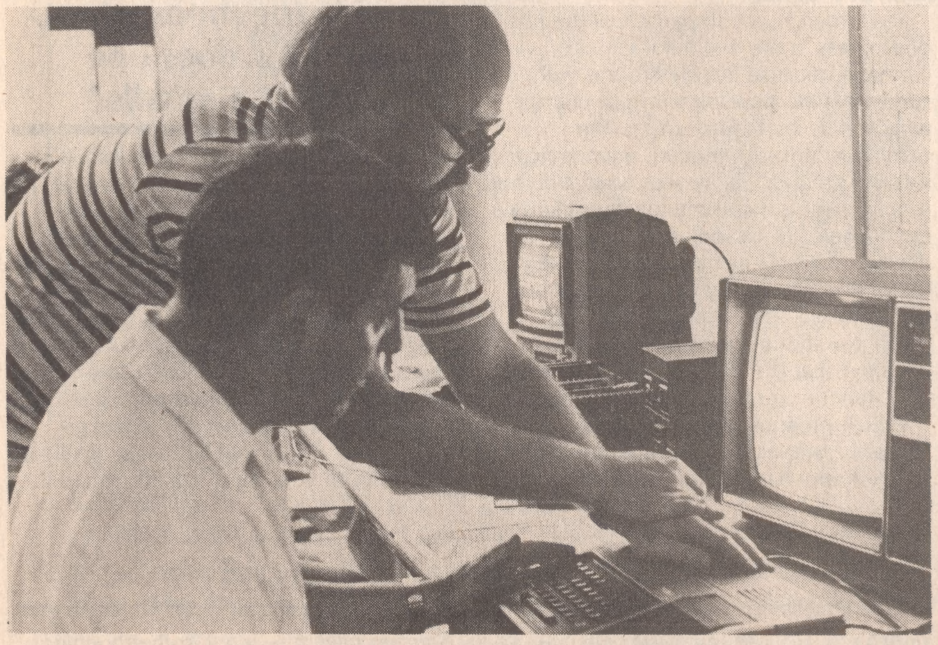
To help Massachusetts teachers and media specialists answer some of these questions, Stacey Bressler of Metropolitan Educational Television organized a week-long conference at the Mount Hermon School near Greenfield, Mass. last July.

The teacher's first problem, said several speakers, is defining what a computer is, and perhaps more important, what it is not, in educational terms. Educators have long believed that teaching machines — from Pressey's 1926 Self Scoring Multiple Choice Device to Skinner's teaching machines of the 50's and 60's — would radically improve teaching. When students got bored or support disappeared, teachers became disappointed. Though microcomputers are hundreds of times more powerful than the old mechanical teaching machines and also less expensive, they are not a cure-all. Teachers must carefully define what computers can do.

Walter Koetke, computer services director of the Putnam/North Westchester B. O. C. E. S., offered one possible definition. The microcomputer is, he said, an instrument for writing, composing music, designing games and simulating historical events or science experiments. By following students' associations and questions about a subject, the computer can help children learn in a way never before possible. In effect, the computer could change education as textbooks did 100 years ago.

The first years of microcomputers in schools will not be easy, however, suggested Daniel Watt, a member of MIT's Project LOGO. Teachers will have to both learn programming and master their machines. Universities are only now beginning computer science programs designed especially for teachers. Adapting new curricula will be difficult as long as schools are being judged by old policies. Students who become good programmers will assume an increased amount of power in their schools, possibly threatening some teachers.

But perhaps the most serious problem facing teachers is the lack of good software. Because of the problems with software, teachers with new computers should assume that they will have to write some of their own educational programs, conference participants felt. They added that, with support from administration so that teachers have time to work in teams, teachers will be able to write good software, though it may lack the fancy graphics routines that professional programmers write.



Massachusetts teachers gathered around the micros during a week-long conference exploring what computers can and can't do in education.

Media Librarian as Activist

Tomorrow's technologies — including "intelligent telephones," electronic publishing and videodiscs — might limit rather than increase access to communication channels, but the media librarian could help counter that trend, believes Amos Vogel of the Annenberg School of Communication, University of Pennsylvania.

Speaking at a June institute on "Changing Technology and the Media Librarian of the 80's," Vogel said he foresees a future in which large economic interests control access to public channels, resulting in a profusion of "video wallpaper" and fewer controversial productions than are broadcast now. Such programming for "the lowest common denominator" will limit people's access to stimulating ideas, he said.

Vogel hopes that librarians will support non-commerical and controversial producers and artists by becoming repositories for non-popular and underground information sources.

"Changing Technology and the Media Librarian of the 80's," sponsored by the Library and Information Technology Association of the American Library Association and by the Educational Film Library Association, preceded the 1980 American Library Association Annual Conference in New York City.

Computer Literacy Comes to TV

Within the next year, various national public television networks will present a video series on computer literacy. Stations and times of presentations will vary. The series, entitled "Adventures of the Mind," consists of six, 15-minute lessons about computers and their uses:

LESSON 1—*How Computers Serve Personal Interest* (A look at computers as personal tools)

LESSON 2—*Hardware and Software: Computer Components and Function* (Identification and description of the five hardware components of a computer and of software systems and applications)

LESSON 3—*Speaking the Language: Communication with the Computer* (An introduction to programming in BASIC)

LESSON 4—*Data Processing, Control, Design: Personal Computer Applications* (An illustration of the three major classes of computer applications)

LESSON 5—*For Better or Worse: Advantages and Disadvantages of Personal Computers* (The potential benefits and problems to individuals and society in the computer age)

LESSON 6—*Extending the Reach: The Impact of Personal Computers on the Individual* (Special people using personal computers to meet special needs and to communicate ideas)

Children's Television International (a Virginia-based educational network) and the Johns Hopkins University Applied Physics Laboratory produced "Adventures of the Mind;" Radio Shack and The Institute of Electrical and Electronics Engineers Computer Society provided funding.

For further information and local scheduling times, contact: Susan Dawson, Children's Television International, One Skyline Place, Suite 1207, 5205 Leesburg Pike, Falls Church, VA 22041; 703-379-2707.

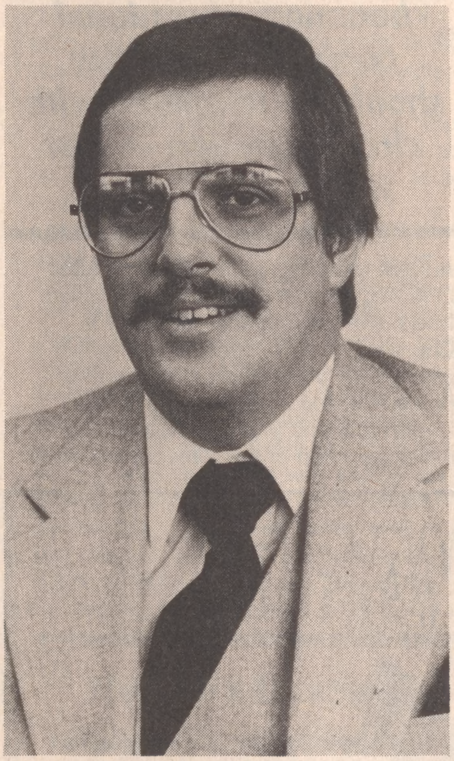
Best Yet to Come, Says Speaker

In the next two to five years, the microcomputer will become "friendlier." It will speak when spoken to. It will wow its user with 3-D graphics and real-time animations, hum the Bee Gees or Beethoven. It will hold more information, communicate more easily with its fellow machines and come in sizes that will make today's micros look macro.

At a recent Boston Computer Society meeting, Vern Rayburn, president of Microsoft Consumer Products, outlined these and other developments that will influence the classroom use of computers. Rayburn, whose firm supplies BASIC for almost every major microcomputer, sees the development of better software as the number one challenge facing the industry.

"Software defines the personal computer," he said. But much available software is hard to use and of low quality, making software the "major element missing today for widespread acceptance of the microcomputer." Two trends should change this. First, programmers are beginning to "innovate rather than imitate." By writing programs expressely for the microcomputer, not mimicing those designed for larger machines, they are taking maximum advantage of the micro, especially the high level of interactivity it offers. Manufacturers are also starting to standardize programs so that one piece of software will service a variety of machines — a welcome change for the school that owns an assortment of PETs, Apples and TRS 80s.

As software improves, so will the ease of user-machine communication. Command languages will sound more like English; joy sticks and light pins, which facilitate movement through a program, will be cheaper; and the computer will respond to spoken commands, though Rayburn says this "ultimate step in making the computer friendly" is still about five years away.



Microsoft's Vern Rayburn

As for the machines themselves, some will be smaller and cheaper (a hand-held, $200 model is already on the market; Commodore will soon introduce a $350 machine featuring full color graphics); others, like the Apple III, will be full-feature machines, with such current extras as floppy disks and modems built in. Both graphics and sound capabilities will improve, with real-time animation, 3-D graphics, and full music and voice synthesis available. Equally exciting is the move toward computer networking, through which all the microcomputers in all the schools in a system could talk to one another, combining their enormous reasoning power and memories.

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Industry

Continued from page 1

similar increases — Control Data reached the total 1979 sales figure in the first six months of the year. Apple Computer Inc., which sells heavily to the education market, has an annual reported growth rate of 50 percent. Radio Shack reports that last April, May and June's sales together equaled the sales for the first nine months of the previous year. Commodore, Atari and Exidy Computer report similarly impressive figures.

Excitement about the booming educational computing industry should be tempered by circumspection, however. Just what resources are the various micro and minicomputer manufacturers committing to education? What role are educators playing? What do the answers to these questions imply for the future of educational computing?

Let's look at some of these companies and their commitment to education.

Honeywell

Honeywell produces minicomputer systems with educational applications. Honeywell software includes both a student scheduling system called SCRIBE and a time-share library for educators called EDINET, which includes tutorial, drill and simulation learning activities for children. Honeywell personnel are now working on a version of the LOGO language (a computer language developed expressly for educational use) for the Honeywell minicomputer. In general, Honeywell's interest in education lies in minicomputer-based time-sharing systems and in instructional programs dealing with problem solving. They develop most of their software in-house with some field testing.

IBM

IBM has many general computer systems used in schools. The 4300 and 8100 mainframes are two examples. The software for these systems include a student record-keeping program called EPIC and an instructional system called Interactive Instructional System (IIS). Courseware for IIS consists of installed-user and field-tested programs in data processing and in remedial math and English drill and practice. Again, IBM develops much of the software in-house.

> ***Excitement about the booming educational computing industry should be tempered with circumspection — just who is doing what?***

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Digital

The PDP-11, PDP-8 and VAX systems are the three Digital computers most employed in education. Digital sells applications software for its systems but also has a special education group which provides support to educators in several ways. First, this group develops software jointly with Digital systems users. A users' group, Education Special Interest Group (EDUSIG), contributes programs to Digital's education library. Programs from this library are then available to system users at a nominal cost. In addition, Digital produces a quarterly magazine with articles by both educators and Digital staff members. The magazine also includes presentations of new Digital software and hardware.

Control Data Corporation

Control Data developed PLATO, a computer-based education network consisting of both hardware and software, in 1967. It is essentially a time-share system used in both private industry employee training and public and private education. The programs range from basic skills to business and accounting courses. PLATO courses are also used in Control Data Institutes. These programs, which were field-tested at the University of Illinois, allow the teacher to choose from several different modes of instruction — interactive, remedial or simulation, for example. Control Data employees created the programs in conjunction with educators at the University of Illinois.

Apple Computer Inc.

Apple Computer primarily produces a microcomputer, the Apple II (a new Apple will soon be introduced), for classroom use. While Apple does provide many applications programs for special functions with the computer, independent software houses produce most of the software for the Apple II. Apple also supports the Apple Foundation, a nonprofit organization that gives assistance, primarily in the form of hardware, and some financial support, for educational computer projects. Apple also publishes a newsletter for and by Apple computer users.

Through a special agreement Bell & Howell is now developing Apple software. One software package already available, Genis, is composed of two software systems. With one system, a teacher with no previous programming experience can create programs; with the other, educators can use a kind of computer shorthand to develop lessons more quickly and easily. In essence, Bell & Howell will operate as a systems house (a company that takes a system, adds to or modifies it, and then resells it) for Apple.

Commodore Business Machines

Commodore Business Machines'

primary contribution to the educational computing market is the Commodore PET microcomputer. Much educational software is available for the PET. As with the Apple, it comes from diverse groups and software companies that develop software for mini and microcomputer sytems.

Atari

While known for its home video games, Atari is strongly aware of the importance of the educational computer market. It has entered into an agreement whereby Science Research Associates (SRA) will develop educational software for the Atari 800 and 400, Atari's home computer systems.

SRA has developed a classroom management system for testing, diagnosing, prescribing, record-keeping and report generating in math, grades four through eight. In addition to this management system, an *Automated Instruction Drill and Evaluation Package* for math, grades four through eight, will be released this fall. SRA has been working on computer curriculum for the past year.

Texas Instruments

Texas Instruments' major contributions to the educational market are a series of microprocessor-based learning aids such as *Speak n' Spell, Speak n' Read* and *Speak n' Math* (these employ verbal as well as visual instruction) and a personal computer, the Texas Instruments 99/4. Texas Instruments' major thrust, however, is the home computer market.

Texas Instruments has a special group of people in-house who determine the specific educational applications of their products and who design the educational packages. These people are called the learning factors engineering group.

Radio Shack

Officials at Radio Shack insist that they don't want Radio Shack identified only as a "hardware peddler." Using both in-house people and educators using the Radio Shack microcomputer, Radio Shack has been developing software for its TRS-80 microcomputer for the past year. The software now consists of a computer literacy course and a drill-and-practice math program (K-8). Radio Shack plans to develop and field test a language arts and reading program. Although users groups write for the TRS-80, Radio Shack prefers "to write our own software and stand behind it."

Where do educators fit into this picture? Has the educational community, as a top Radio Shack official claims, "abdicated its responsibility in educational computing," so that hardware developers must set the pace?

The answer, unfortunately, must be yes. Individuals and groups of educators are coming to terms with educational computing, but the educational community has not yet become unified enough to develop a comprehensive, national policy. As a result, the picture of educational computing is one of disorganization and lack of communication among various groups.

For example, industry is developing hardware and software, mostly of its own initiative, with some support from educators; they've developed some excellent time-share programs in conjunction with university personnel. However, educators have most often acted in consultative rather than directive roles. Microcomputer software development is in even greater disarray. About 120 software firms sell educational packages. While some of this software is educationally sound, quality is such a problem that one educational computer consortium director says, "there is so much trash out in terms of software that it's very difficult for the teacher to buy intelligently."

Educators do work independently in all areas of educational computing. Some develop programs that they share with their own immediate group of educators; others contribute programs to users' group libraries supported by some computer manufacturers. However, communicating achievements beyond one's immediate personal contacts or users' groups is problematic. In addition, some of the programs developed this way are not immediately transferable to other educators; their applications may be very specific and bound to certain situations. Educational computing consortiums have been set up throughout the country, but their numbers are still limited. While these consortiums have developed some excellent educational programs, communication with other educators still presents a problem. A strong educational computing network just does not exist.

Has the educational community abdicated its responsibility for educational computing?

Within the past year, another participant has entered the software field. Educational publishers are just now "waking up," in the words of one computer company executive, to the potential in developing software, especially software for microcomputers. Scott Foresman and Company is now working on software curriculum for the Texas Instruments 99/4 home computer; Milikin Publishing Company is developing programs for the Apple computer; McGraw-Hill Company is working on materials for Digital Equipment Corporation's small computer systems. SRA and Bell & Howell are involved with Atari and Apple, respectively. As Richard Cavagnol, a curriculum development director at SRA, says, "up till now, all the emphasis has been on hardware, with too little emphasis on software. Software needs to be introduced properly to expand the capability of a system." Both educational publishers and computer manufacturers are realizing this and are entering into mutually beneficial agreements.

Computer use in the schools is relatively new (especially microcomputer use, which has skyrocketed in the past year and a half), and educators have not had much time to network. But these factors cannot completely excuse educators from exerting an educationally sound influence on educational computing. Technology is developing so rapidly that educators can no longer allow themselves to be left behind. Now is the time that educators, as a unified group, must take firm control of all areas of educational computing development. Given the present crisis in education, the chance, once forfeited, may never come again.

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Grămaze

Let the computer — and the dragon — take the drudgery out of teaching grammar

by Jeff Nilson

When you are 13 and unsure of who you are, of where your life is going and of how your body will change next, a noun receiving the action of a verb is hardly a noteworthy event — unless the verb is "kiss" or "punch," and you are the noun. This seeming irrelevance turns many junior high school students off to learning grammar and mechanics. They don't see why they should. But schools that in the late 1960's and the early 1970's tried to lure the Woodstock generation with courses on silent movies and science fiction are toughening up. Competence is the catchword these days, and in many schools the basis of competence is grammar.

This does not mean that English teachers will have to spend hours drilling bored students on adverb clauses or expounding on the architectural beauty of a properly diagrammed gerund. Nor need teachers resort to the castor oil speech, "Anything that tastes as bad as grammar has to be good for you. . . ." Students are wise to such appeals, which by now hardly disturb their sleep.

With the coming of inexpensive microcomputers, students who have grown up with *Sesame Street* and *Charlie's Angels* at last have machines challenging enough to keep their interest — even while learning grammar. Indeed, more and more educational programs for microcomputers are appearing on the market, filling a growing demand.

The computer tantalizes teachers. Good software could free them from much of the drudgery involved in teaching basic skills, while at the same time making it fun for kids to learn the skills. Unfortunately, most of the available language arts software doesn't do the job.

Lessons usually begin with some funny graphics to catch students' attention and to lead them to the rule they're supposed to learn. Some practice questions follow, with smiles or "good jobs" if the answers are correct, buzzes and frowns if they are wrong. In a sense, the computer guides students through a linguistic Skinner box until they emerge enlightened about subjects, objects, commas, consonant blends, homonyms or the like. Unfortunately, after the novelty of pecking away at a computer keyboard wears off, the students end up bored. Students want to work more creatively with the computer: writing programs, playing games or using the computer as a tool to help them write a story or study a problem. To achieve this, teachers with new microcomputers in their schools will have either to wait until publishers produce quality material or to learn some programming and write their own software.

Teachers with minimal programming experience could write drill and practice programs similar to those appearing on the market, minus the fancy graphics. Language arts and reading programs that branch to short sub-lessons only when the student makes mistakes on certain questions also do not require professional programming ability. And educational games like *Synonym*, by Walter Koetke, are not complex; skilled teacher-programmers could write similar games. Just watch kids playing at a computer store or at a penny arcade and you'll see the enormous appeal such games have for students.

> **With inexpensive microcomputers, students who have grown up with Sesame Street and Charlie's Angels at last have machines challenging enough to keep their interest — even while learning grammar.**

Last summer, excited about my new Apple computer and still shuddering from trying to teach direct objects to eighth graders, I designed a game to help me teach direct objects. Ideally, the core of a grammar game would allow students to explore aspects of grammar, much as players make words to play *Scrabble*. The educational purity of *Scrabble* is hard to match, however, and I had to compromise. I ended up using the game as an excuse to identify direct objects, with the grammar work determining only whether a student moves or not.

When *Gramaze* begins, the player is imprisoned in a rectangular grid drawn in Apple low-resolution graphics. To escape, the student, who is given a white square token must move sequentially through some lettered squares to an opening in the wall. Answering a question about direct objects correctly entitles the escapee to hop from one square to the next. The game is simple, except for the dragon. The dragon, a ferocious red-orange square, loves to eat students. One mistake and the dragon moves one square closer to the white token. Too many mistakes and . . . gulp! And to make things worse, sometimes the dragon moves on its own, even if the student knows the answers. Ah, but that is life.

Gramaze uses an array to store the questions and answers. Choose a space in *Gramaze*, and out pops the question that goes with the space. The student feeds in the answer, and the computer matches it with the answer it has stored for that question. If the student is correct, a graphics routine makes the old token disappear and an identical one appear in the space the student chose. The coordinates for the new space are also stored in the array.

To track the token if the student makes a mistake, the dragon begins with the token's coordinates and the computer's knowledge of the four moves the dragon can make: up, down, right or left. The computer figures the distance between the token and each of the places the dragon can move. Using a sorting routine, the computer picks the shortest distance. Then, with an ominous buzz, it moves the dragon to the space that produces the shortest distance. The dragon's unpredictability comes from a statement that produces one of four numbers in random order. Whenever one particular number comes up, the program switches to the section that moves the dragon.

I tried *Gramaze* with my own children, who are middle school age. They enjoyed the first version, with its small set of sentences and simple jail, until they figured it out. The final form of the game will contain several sets of sentences of increasing difficulty and a way of drawing more complex prisons. Adding a second player and a way to keep score should heighten interest enough so that some of the labor involved in teaching direct objects will be taken over by the computer . . . and the dragon.

Cont.

Jeff Nilson teaches eighth-grade English in Dennis, Mass.

Gramaze Program Listing

```
]LIST
10  HOME
11  PRINT "WELCOME TO GRAMAZE.  IT
                 IS A GAME "
20  PRINT "FOR PEOPLE WHO LIKE TO
     PLAY GAMES"
30  PRINT "WHILE LEARNING GRAMMAR
     "
40  INPUT "WHAT IS YOUR NAME? (TY
     PE IN YOUR NAME, AND THEN HI
     T THE RETURN KEY.)";NAME$
50  PRINT
60  PRINT
65  HOME
70  PRINT "TO WIN GRAMAZE,"NAME$"
     ,YOU MUST ESCAPE"
75  PRINT "FROM THE JAIL BEFORE T
     HE DRAGON EATS"
80  PRINT "YOU.  YOU CAN MOVE ONE
     SPACE UP OR "
90  PRINT "ACROSS WHEN YOU ANSWER
      A QUESTION"
100  PRINT "ABOUT DIRECT OBJECTS
     CORRECTLY.
105  PRINT
106  PRINT
110  PRINT "IF YOU MAKE A MISTAKE
       THE DRAGON"
120  PRINT "WILL MOVE ONE SPACE T
     OWARD YOU.  TOO"
130  PRINT "MANY MISTAKES AND . .
        GULP!!  YOU LOSE."
132  PRINT : PRINT : PRINT "BE CA
     REFUL!!"
134  PRINT "SOMETIMES THE DRAGON
     MOVES ON ITS OWN."
140  INPUT "HIT THE RETURN KEY WH
     EN YOU ARE READY TO PLAY.";B
     EG$
149  REM  THIS SECTION DRAWS THE
     JAIL.
150  GR : COLOR= 2
160  VLIN 3,39 AT 1: VLIN 3,39 AT
     10: VLIN 3,39 AT 19: VLIN 3,
     39 AT 28: VLIN 3,39 AT 37
165  HLIN 1,37 AT 3: HLIN 1,37 AT
     12: HLIN 1,37 AT 21: HLIN 1,
     37 AT 30: HLIN 1,37 AT 39
180  COLOR= 1
190  VLIN 8,10 AT 4: VLIN 15,17 AT
     4: PLOT 4,19: VLIN 24,28 AT
     4: VLIN 33,37 AT 4
200  PLOT 5,8: PLOT 5,10: PLOT 5,
    15: PLOT 5,17: PLOT 5,19: PLOT
    5,24:: PLOT 5,35: PLOT 5,37
210 VLIN 6,10 AT 6: PLOT 6,15:VLIN
    17,19 AT 6: PLOT 6,24:VLIN
    35,37 AT 6
220 VLIN 6,10 AT 13: VLIN 15,19 AT
    13: VLIN 24,28 AT 13: PLOT 1
    3,33: VLIN 35,37 AT 13
230 PLOT 14,8: PLOT 14,19: PLOT
14,24: PLOT 14,26: PLOT 14,3
3: PLOT 14,35: PLOT 14,37
240  VLIN 8,10 AT 15: PLOT 15,19:
      PLOT 15,24: VLIN 33,37 AT 1
     5
250  VLIN 24,27 AT 21
260  PLOT 22,6: VLIN 15,19 AT 22:
      PLOT 22,27: VLIN 33,37 AT 2
     2
270  VLIN 6,10 AT 23: PLOT 23,18:
      VLIN 25,27 AT 23: PLOT 23,3
     3: PLOT 23,35
280  PLOT 24,6: PLOT 24,17: PLOT
     24,19: PLOT 24,27: VLIN 33,3
     5 AT 24
290  VLIN 24,27 AT 25
300  VLIN 16,19 AT 30: VLIN 24,27
      AT 30
310 VLIN 6,9 AT 31: PLOT 31,16:PLOT
     31,24: VLIN 33,35 AT 31: PLOT
     31,37
320  PLOT 32,9: PLOT 32,17: VLIN
     24,26 AT 32: PLOT 32,33: PLOT
     32,35: PLOT 32,37
330VLIN 6,9 AT 33: PLOT 33,18:PLOT
     33,24: VLIN 33,37 AT 33
340  VLIN 16,19 AT 34: VLIN 24,27
      AT 34
350  REM  THIS SECTION BUILDS THE
      ARRAY.
360  DIM A$(16),B$(16),C$(16),M(1
     6),N(16),R(16),S(16),V(16),W
     (16),D$(16)
370  FOR N = 1 TO 16
380  READ A$(N),B$(N),C$(N),M(N),
     N(N),R(N),S(N),V(N),W(N),D$(
     N)
390  NEXT N
400  DATA  D, THE CLASS HELD A DA
     NCE.,DO,8,5,35,23,25,39,DANC
     E
410  DATA  S,THE STAIR CREAKED SO
     FTLY.,SUB,8,14,0,0,0,0,STAIR

420  DATA  R,MARY WON THE RACE.,D
     O,8,23,0,0,0,0,RACE
430  DATA  B,I MADE A BET WITH TO
     M.,DO,8,32,35,14,25,3,BET
440  DATA  H,HER HEAD BEAT LIKE A
      DRUM.,SUB,17,5,0,0,0,0,HEAD

450  DATA  L,BILL TORE THE LABLE
     OFF.,DO,17,14,0,0,0,0,LABLE
460  DATA  F,FERNS FILLED THE WIN
     DOW.,SUB,17,23,0,0,0,0,FERNS

470  DATA  A, THE AIR SMELLED LIK
     E ORANGES.,SUB,17,32,0,0,0,0
     ,AIR
480  DATA  T,JANE REFINISHED THE
     TABLE.,DO,26,5,0,0,0,0,TABLE
490  DATA  K,THE KNOT TIGHTENED I
     N THE RAIN.,SUB,26,14,0,0,0,
     0,KNOT
500  DATA  W,BARBARA CONNECTED TH
     E WIRES.,DO,26,23,0,0,0,0,WI
     RES
510  DATA  P,THE POND WAS FILLED
     WITH LILLIES.,SUB,26,32,0,0,
     0,0,POND
520  DATA U,TIM'S UNCLE TEACHES M
     ATH.,SUB,35,5,8,23,16,39,UNC
     LE
530  DATA  N,A STRANGE BUZZING FI
     LLED THE NIGHT.,DO,35,14,0,0
     ,0,0,NIGHT
540  DATA  M, BILL HUGGED HIS MOT
     HER.,DO,35,23,0,0,0,0,MOTHER

550  DATA  G,THE SUN TURNED THE B
     ROKEN GLASS INTO JEWELS.,DO,
     35,32,8,14,16,3,GLASS
559  HOME
560  INPUT "WHERE WILL YOU BEGIN
     YOUR ESCAPE? (TYPE IN D,B,U,
      OR G)";ANS$
570  FOR N = 1 TO 16 STEP 3
580  IF AN$ = A$(N) THEN 600
584  NEXT N
590  PRINT "YOU CAN'T START AT "A
     NS$" . YOU WILL BE CAUGHT.":
   FOR C = 1 TO 1600: NEXT C: HOME
     : GOTO 560
600  IF AN$ = "K" THEN 590:
602  IF AN$ = "F" THEN 590:
610  COLOR= 13: LET X = M(N):Y =
     N(N): PLOT X,Y: PLOT X + 1,Y
     : PLOT X,Y - 1: PLOT X + 1,Y
      - 1
611  HOME
612  PRINT "THE WHITE SQUARE,"NAM
     E$",IS YOUR TOKEN."
614  FOR C = 1 TO 2000: NEXT C
618 XI = V(N)
619 XY = W(N)
620  COLOR= 0: FOR A = 0 TO 2: PLOT
     V(N) + A,W(N): NEXT A
621  HOME
622  PRINT "YOU ESCAPE THROUGH TH
     E BREAK IN THE WALL."
624  FOR C = 1 TO 2000: NEXT C
630  COLOR= 8: LET D = R(N):R = S
     (N): PLOT D,R: PLOT D + 1,R:
      PLOT D,R - 1: PLOT D + 1,R -
     1
631  HOME : FOR C = 1 TO 1000: NEXT
     C
632  PRINT "AND THE RED SQUARE IS
      THE DRAGON."
636  FOR C = 1 TO 3000: NEXT C
650  HOME : PRINT "YOU MUST CHOOS
     E A SPACE"
655  PRINT "NEXT TO THE SPACE YOU
     R TOKEN IS IN."
```

```
 659 FOR C = 1 TO 2500: NEXT C:HOME

 660  PRINT "YOU MAY NOT MOVE DIAG
        ONALLY."
 665 FOR C = 1 TO 2500: NEXT C: HOME

 670  HOME : INPUT "WHICH SPACE WI
        LL YOU MOVE TO?";MOVE$
 672 RD =  INT (5 *  RND (1)) + 1
 674  IF RD = 2 GOTO 800
 680  FOR N = 1 TO 16
 684  IF A$(N) = MOVE$ GOTO 700
 688  NEXT N
 700  IF  ABS (M(N) - X) +  ABS (N
        (N) - Y) = 9 GOTO 708
 702  IF  ABS (M(N) - X) = 15 GOTO
        708
 704  IF  ABS (N(N) - Y) = 15 GOTO
        708
 707 PRINT "WHOOPS.  TRY AGAIN.":FOR
        C = 1 TO 500: NEXT C: HOME :
         GOTO 670
 708  HOME : PRINT B$(N): FOR C =
        1 TO 1600: NEXT C: GOTO 712
 712  PRINT "IS   "D$(N)"  A SUBJE
        CT OR A DIRECT OBJECT? (TYPE
         IN SUB OR DO)": INPUT TRY$
 720  IF TRY$ = C$(N) GOTO 750
 730  GOTO 800
 750  COLOR= 0: PLOT X,Y: PLOT X +
        1,Y: PLOT X,Y - 1: PLOT X +
        1,Y - 1
 760  COLOR= 13:X = M(N):Y = N(N):
         PLOT X,Y: PLOT X + 1,Y: PLOT
        X,Y - 1: PLOT X + 1,Y - 1:
 762  IF XI = X - 1 GOTO 764
 763  GOTO 670
 764  IF XY = Y - 2 GOTO 1400
 765  IF XY = Y + 7 GOTO 1408
 766  GOTO 670
 800  COLOR= 0: PLOT D,R: PLOT D +
        1,R: PLOT D,R - 1: PLOT D +
        1,R - 1
 803  FOR I = 1 TO 30:A =  PEEK ( -
        16336): NEXT I
 805 H = D + 9:I = R - 9:J = D - 9
        :K = R + 9
 808 VV =  SQR ((D - X) ^ 2 + (R -
        Y) ^ 2)
 810 WW =  SQR ((H - X) ^ 2 + (R -
        Y) ^ 2)
 820 XX =  SQR ((D - X) ^ 2 + (I -
        Y) ^ 2)
 830 YY =  SQR ((J - X) ^ 2 + (R -
        Y) ^ 2)
 840 ZZ =  SQR ((D - X) ^ 2 + (K -
        Y) ^ 2)
 850 T = VV
 860  IF WW < T GOTO 880
 870  GOTO 1000
 880 T = WW
1000  IF XX < T GOTO 1020
1010  GOTO 1030
1020 T = XX
1030  IF YY < T GOTO 1050
1040  GOTO 1060
1050 T = YY
1060  IF ZZ < T GOTO 1080
1070  GOTO 1100
1080 T = ZZ
1100  IF T = WW GOTO 1102
1101  GOTO 1103
1102  COLOR= 8: PLOT H,R: PLOT H +
        1,R: PLOT H + 1,R - 1: PLOT
        H,R - 1: LET D = H: GOTO 121
        5
1103  IF T = XX GOTO 1105
1104  GOTO 1106
1105  COLOR= 8: PLOT D + 1,I: PLOT
      D,I - 1: PLOT D + 1,I - 1: PLOT
        D,I:R = I: GOTO 1215
1106  IF T = YY GOTO 1108
1107  GOTO 1200
1108  COLOR= 8: PLOT J,R: PLOT J +
        1,R: PLOT J,R - 1: PLOT J +
        1,R - 1:D = J:R = R: GOTO 12
        15
1200  IF T = ZZ GOTO 1210
1210  COLOR= 8: PLOT D,K: PLOT D +
        1,K: PLOT D,K - 1: PLOT D +
        1,K - 1:R = K: GOTO 1215
1215  IF T = 0 GOTO 1300
1220  GOTO 670
1300  FOR I = 1 TO 50:A =  PEEK (
        - 16336) +  PEEK ( - 16336)
        +  PEEK ( - 16336): NEXT I
1310  TEXT : HOME : FOR C = 1 TO
        6: PRINT : NEXT C
1320  PRINT "THE DRAGON ATE YOU,
        "NAME$"  ."
1324  PRINT "YOU NEED SOME MORE P
        RACTICE WITH DIRECT OBJECTS;
        ": FOR C = 1 TO 1000: NEXT C

1330  PRINT "OR SOME DRAGON REPEL
        LANT."
1338  FOR C = 1 TO 4: PRINT : NEXT
        C
1339  FOR C = 1 TO 1000: NEXT C
1340  PRINT "IF YOU WISH TO PLAY
        AGAIN,TYPE IN RUN."
1350  END
1400 COLOR= 13: FOR C = 0 TO 4:PLOT
      X,Y - C: PLOT X + 1,Y - C: NEXT
        C
1402 FOR C = 0 TO 3: COLOR= 0: PLOT
      X,Y - C: PLOT X + 1,Y - C: NEXT
        C: GOTO 1420
1408  COLOR= 0: PLOT X,Y: PLOT X +
        1,Y: PLOT X,Y - 1: PLOT X +
        1,Y - 1: COLOR= 13: FOR C =
        0 TO 9: PLOT X,Y + C: PLOT X
         + 1,Y + C: NEXT C: FOR C =
        0 TO 8: COLOR= 0: PLOT X,Y +
        C: PLOT X + 1,Y + C: NEXT C:
         GOTO 1420
1420  TEXT : HOME : FOR C = 1 TO
        5: PRINT : NEXT C
1425  PRINT "CONGRATULATIONS,   "N
        AME$"!"
1429  FOR C = 1 TO 1000: NEXT C
1430  PRINT "YOU HAVE DEFEATED TH
        E DRAGON.   YOU MUST"
1435  PRINT "KNOW SOMETHING ABOUT
        DIRECT OBJECTS;": FOR C = 1
        TO 1200: NEXT C
1439  FOR C = 1 TO 5: PRINT : NEXT
        C
1440  PRINT "OR YOU DON'T LIKE DR
        AGON BREATH.": PRINT : PRINT
1445  PRINT "TYPE IN 'RUN' IF YOU
        DARE PLAY AGAIN."
1449  FOR C = 1 TO 1000: NEXT C
1450  PRINT "AND BE SURE TO HAVE
        YOUR TEACHER 'SCALE' YOUR GR
        ADE."
1460  END
```

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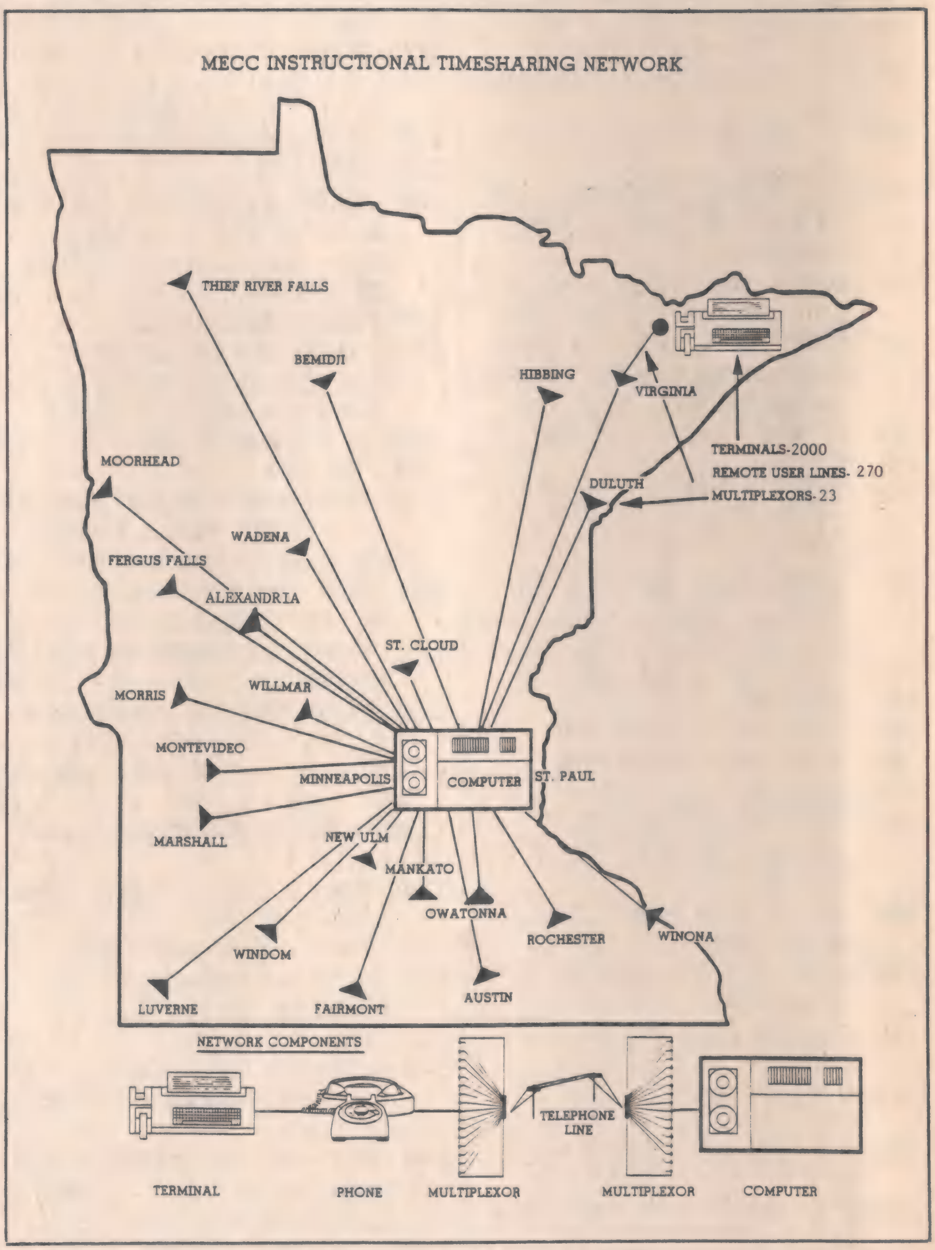
The Minnesota Connection

Delivering a diversity of services statewide, the Minnesota Educational Computing Consortium offers a model for the nation



From time to time, Classroom Computer News *will run question-and-answer interviews with leaders in the educational computing field. To begin this series, Features Editor Phyllis Caputo talked with Dr. John Haugo, executive director of the Minnesota Educational Computing Consortium (MECC). Dr. Haugo talked about the consortium and current issues concerning teachers and administrators interested in the classroom use of computers.*

Q. Dr. Haugo, can you tell us about MECC? How it's organized and what its role is?

A. Sure. MECC is a statewide computer service organization whose members are the public school systems of Minnesota, the University of Minnesota, the state university system, the state community college system and the state Department of Education. MECC has two basic roles: One is planning and coordinating all computer services, and the other is delivering these services.

In the area of computer services, we manage information systems, provide instructional services and develop special projects, typically research on the use of computers.

In the instructional area, we have three kinds of services. One is a time-share system that encompasses the whole state and higher education institutions. About 90 percent of Minnesota schools are linked into this system. The second thing we do is broker the PLATO system. In the third area, Apple microcomputers have been acquired recently, and we are providing support for the systems through software and training programs. Our time-share software is now being translated for Apples.

Q. How long have you been operating, and how did MECC begin?

A. We were created seven years ago this past summer (1973) and have actually provided services these past six years. We began as a result of a task force put together by our governor to look at the problems associated with educational computing. The task force established MECC to deliver services on the state level.

Q. What were some of the problems you faced in establishing MECC?

A. There are always technical, economic and political problems. On the technical side, initially we had some problems just installing the telecommunications network and getting a computer that could handle that many users. With microcomputers, we had to determine the kinds of peripherals that would make sense in education.

On the economic side, in order to have a statewide cooperative, you need a large funding base and a commitment from the state. Fortunately, we have had that. Then the political problems were the following: We had the problem between the haves and the have-nots. People who had computer capabilities, like our universities and large school systems, felt they didn't have much to gain from a cooperative effort. Therefore, they were less cooperative, at first, than those who didn't have any capabilities.

On the legislative level, we're sometimes subject to second-guessing by legislators of more operational decisions. Not that there shouldn't be oversight at the state level.

Q. What is the role of parents in MECC?
A. The parents of some of our students are involved indirectly by being on our board of directors. And at the school level we have many parents who are aware — in Minnesota we have many parents who are involved in the computer industry — and they make good suggestions. Parents were one of the original motivating forces in Minnesota because they were so computer literate.

At this point, schools are getting parents involved. Students take terminals home for the night and some parents become knowledgeable. We sell time-sharing to parents at a reasonable rate. Also, parents work as aides and volunteers in educational computing areas. A common involvement is for them to work actively in labs with terminals or microcomputers, assisting kids in using the equipment.

Q. What is the extent of your involvement with time-sharing?
A. Our system has 425 ports, or links, so that in theory, that many users could use the system simultaneously. Typically, we have about 300 to 350 simultaneous users.

Q. How does a district or a school system in Minnesota acquire a port into the system?
A. Ports are not assigned. The school districts determine themselves what they want. Some will buy a number of ports, like Minneapolis and St. Paul —they bought between 20 and 40. Some will only buy a share of a port, so that they and two other users will use the same port. Then they schedule accordingly.

The districts provide their own local communication costs through their local telephone systems; they pay for their own terminals and their own time on the system. The state subsidizes or supports the communication network from the local unit to the St. Paul computer.

Q. Considering the growing role of microcomputers, what do you see as the future of time-sharing?
A. I think it has a future, but probably in a different mode. Many of the things that can be done on time-sharing can be done on the Apple. However, there are still higher-level languages and large data base applications that are possible only with a larger computer system. There seems to be a continued demand for this. In fact, this year, even with the large number of microcomputer systems, the requests for service for time-sharing actually went up.

One school of thought holds that if you expose students at a young age to microcomputers, as they mature they will want to do more sophisticated operations possible only on larger systems.

There will certainly be some trade-offs in the long run, but we think there is still a need for a host computer for more sophisticated operations. Now we have a central reservoir of software. These can be downloaded and run on a stand-alone system.

Q. What do you think about software currently available for microcomputer systems?
A. It's very limited. The publishers are now starting to produce software. There are some clearinghouses set up to disseminate software, but in general, development is far behind. The computer library we have of down-loaded programs for microcomputers is one of the first in the country.

Q. What do you see as a solution to this problem?
A. It's going to be a mix of things. In the long term, users will become more sophisticated, which many of ours are now with time-sharing. There will be some produced by publishers — also by software houses and by cooperatives like ourselves. The future will see all three producing more. We've just scratched the surface.

Dr. John Haugo

Q. Could you elaborate on the role of educators in developing software for the microcomputer?
A. Educators should be involved in the conceptual design and in reviewing the product by pilot testing. For the most part, educators produce their own software to meet specific needs, but what they produce is not often transferable. It only meets their own situation and may be inefficient from a programming standpoint or poorly documented from a user's standpoint.

We feel that a cooperative group of educators working with some technical people on teams makes more sense. Our team typically consists of one of our staff people as the head, a curriculum design person from a school system or from the state Department of Education, and a programmer.

This may change in the future, as languages become less difficult and people more sophisticated in computer use. Then it might be possible to develop software locally. Right now, much of what is produced locally is not what you'd like to adopt and disseminate to a large school system. It's kind of like having each teacher develop her own text. For the most part, such systems aren't as transportable as what is developed in cooperative ventures.

Q. What about the future of computers in education?
A. I think the surface has just been scratched. Computers have a potential that hasn't been met; the computer is an interactive device and teaching is interaction. The big costs for computers will not be in the hardware, but in developing the kinds of application programs needed for it. No single school or university should bear the cost; it should be a joint effort.

Q. What is the extent of the federal government's support for educational computing?
A. The National Science Foundation has given us a few grants; they have an active program. The new Department of Education recently let out some requests for proposals on providing funding for developing basic skills programs. But it isn't like it was 15 years ago when NSF would pay for any educational computer system. It is better than it has been, but nowhere near what it was a few years back.

Q. Do you maintain contact with other computer consortiums?
A. There is a group, a kind of regional network group, that meets once a year and exchanges information. We maintain informal contacts, too. Most of these groups are institution-based, such as at universities, but the impetus should be coming more from the state and federal governments. The nature of the technology is such that it should be handled on a larger scale, and I would hope the federal government would provide some leadership and incentives to consortiums.

Q. Any other issues you feel are important to educational computing?
A. We'll need a new kind of person to implement the technology. It takes a different type of individual than we've had in the past. It takes a mix of both the technical and the educational background.

Slashing Paper Work with a Microcomputer

by Ken Temkin

Why should teachers have all the fun? School administrators can use microcomputers in dozens of ways. Even if you're an administrator in a school system large enough to have a data processing department with its own minicomputer, or in one using a time-sharing plan, you can make use of a micro.

Micros can release time and space from the larger systems; they offer easier access and quicker response time for certain programs. They are the "appropriate technology" at certain levels of administration: While a superintendent wouldn't put the fiscal budget of an urban school system on a TRS-80, principals or department heads within that system might monitor their own budgets on it.

Of course, some programs may be too complex for your micro. A systemwide equipment inventory, for example, might overload the 32K of memory in your TRS-80. But then, if you divide the inventory by schools and put each school on a separate disk, it just might work.

The following are some areas in which a micro might simplify your job.

Equipment and Furniture Inventory

Some state and local governments require an annual equipment and furniture inventory. If done manually, the task is tedious and repetitive. A computer inventory saves time, labor and money. Additions and deletions throughout the year virtually eliminate the annual inventory. Furthermore, with a computerized inventory you can recognize and justify equipment needs, develop maintenance programs and institute borrowing among schools.

Fiscal Budget

The micro can make preparing the school system's budget easier. You can compare previous years with the proposed budget, including totals, percentages and explanations. You can easily and quickly incorporate changes the superintendent or school committee make during the review process.

Budget and Accounting

Monitoring the budget is important throughout the year. On a monthly basis, you need to report how expenditures stack up against budgets. How much money has been encumbered and paid out? What are the balances? Which purchase orders are outstanding? Are salaries running ahead or behind? The information and format should make for easy analysis of the budget. Problem areas should stand out.

Use of School Buildings

Most districts allow public use of school buildings. Auditoriums, gymnasiums, lecture halls, etc. are sometimes booked solid. Because dates, times and rooms often overlap, reservations should be confirmed. As quick as a wink, a video monitor would let you know who is using what area when. You could avoid the embarrassment of having two organizations show up at the same time.

> ***Microcomputers are the appropriate technology at certain levels of administation. They can save time in dozens of ways.***

Annual Bids

Annual bids for bulk purchase of items as varied as instructional and art materials, custodial supplies, athletic goods, and health and training room supplies are required to comply with various laws.

Preparing for bids involves writing specifications and determining quantities. Awarding orders means selecting vendors, calculating prices and making up delivery schedules. Schools often encounter problems with deadlines, processing time and errors in compilations.

Inventory Control

The task of controlling school supplies in and out of a warehouse is complicated. Who has ordered what? When do we need to reorder items? Why are we out of stock? With a micro, you can forecast usage rates, shelf-life, seasonal peaks, capital requirements and order lead times. You can then decide when and how much to buy.

Staff Overtime and Sick Time

Keeping track of staff overtime and sick time is necessary for payroll. A simple micro program could be enlightening. Simple compilations of month and date, day-of-the-week, holidays and times of day can help pinpoint abuses and trouble spots.

Student Activity Fund Accounting

Extracurricular activities are encouraged in all schools. Sports teams, marching bands, yearbooks, newspapers, student councils, stage clubs, etc. operate like small businesses. The Research Corporation of the Association of School Business Officials recommends that, "Every school district should have in effect rules, regulations, and procedures for accountability of student activity funds."

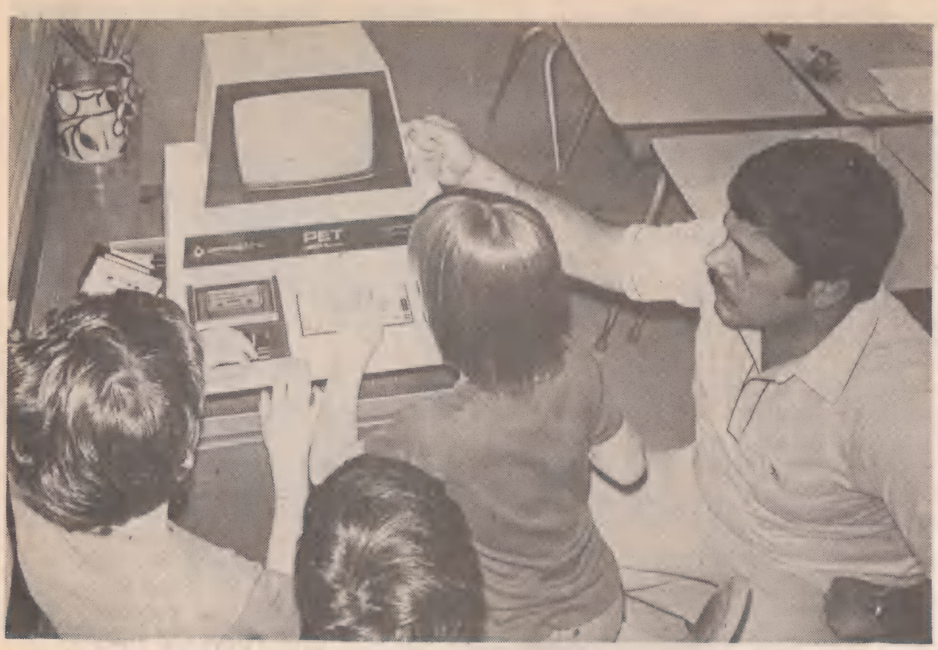
For a bursar, a micro can be a valuable tool. It can record daily transactions, report the financial condition of each activity and reconcile bank accounts in the form of a trial balance.

Other ideas for micro programs include:

Maintenance and repairs
Staff assignments
Theft and vandalism records
Energy monitoring
Transportation and routing
Building history and maintenance
Student accident reports
Classroom assignments
Book inventories
Registration and attendance
Academics
Health records

Who will program all of these? New micro programs appear on the market every day. Check magazines and trade journals; see what other school systems are doing. With very few changes you can adapt programs. Otherwise, try programming yourself. It can be satisfying and fun on a micro.

Kenneth Temkin is the administrative assistant for support services for the Newton Public Schools, Newton, Mass. He is actively writing administrative software.



Joseph Josiassen teaches students in Lexington's Title I program how to use a PET computer.

The Second Coming in Lexington

With 44 micros, two minis, student programmers and in-house training, a New England school system shows what computers in the classroom can mean.

by Bruce Wellman

The classroom use of computers is not new in Lexington, Massachusetts. Located in west-suburban Boston's booming high-technology area, the Lexington public school system has been using computers with its students for the past 15 years.

"The 70's and 80's are really the second-coming for computers in education," said Dr. Frank DiGiammarino, administrative assistant for planning and the driving force behind the Lexington computer program. "During the early 60's, computers came into education for the first time. A lot of federal funds were spent. Most programs were not successful — people weren't sure what to do with the technology, so the feds pulled out. When you're using technology, you really have to know what you're after, so it's not just fun-and-games. The big challenge, as I see it, is to organize this complex network so that you get something that is educationally meaningful."

DiGiammarino is helping Lexington do just that with its own complex network of 44 microcomputers, two minicomputers and 47 terminals hooked into the minis. From computer-assisted instruction in math and reading at the elementary schools, to programming and systems design courses at the secondary level, the school system is integrating computers into its educational program in a planned and unified way.

Lexington first used computers with students in 1965. The junior and senior high schools offered computer-related math courses taught with a Digital Equipment Corporation (DEC) PDP-8 with 14 terminals. Lexington purchased the equipment with federal funds. The program soon expanded to include fifth and sixth graders.

The computer system grew in 1976 with the addition of a DEC PDP-11/40 and 33 terminals. This added power is used for central office functions as well as for instruction. Forty-four microcomputers followed. Most are Commodore PETs of the 2001 series. A few are Apples. All schools in the Lexington system — seven elementary schools, three junior highs and the high school — are equipped.

A half-time specialist in computers and instruction, Beth Loud, was hired in 1978 to help make use of the added computing power. She is a resource person for the teaching staff, and her job is to seek ways for classroom teachers to take advantage of the computers.

Loud is also developing a computer literacy program at the junior high level. It is a prelude to programming; covering the parts and the capabilities of a computer.

The Whiz Kids

DiGiammarino noted that students going through the Lexington schools can learn to program by the seventh grade. "We have some very unusual youngsters here. It's a challenge to keep them challenged.

"For example, a kindergarten teacher was visited one day by a former student then in the seventh grade. She mentioned that if a certain computer game worked differently, it would be better for the kindergarten students to use. The seventh grader sat down and corrected the program."

DiGiammarino recalled another student, a high school sophomore, who developed a way to transfer, or down-load, information electronically from the DEC PDP-11/40 to the PETs. "That resulted in a tremendous amount of savings. We had been doing it by hand before this program solved the problem," DiGiammarino said.

"These kids love to hang around the machines and see what the machines can do," he continued. "Lexington, in its wisdom, allows us to budget money for student programmers."

That money is well spent: A high school senior wrote the program for the school system's budget report. "Its now called the Dirk's Report — I named it after him," DiGiammarino said with a note of pride. "Without that report I would find it difficult to function."

Community Support

The extensive commitment to the use of computers would not be possible without the high degree of support from Lexington's superintendent of schools, Dr. Jack Lawson, the school committee and the parents in the community.

Parents, many of whom use computers in their jobs, have participated in the district's computer program since the early days of the PDP-8 math courses. Their roles have ranged from transporting students to appropriate schools for courses, to working with math specialists on computer math games, to teaching students how to use the terminals and monitoring their progress. They've written many of the educational programs. One parent, for example, wrote over 120 activities to accompany the first four skill levels of Lexington's highly structured reading skills inventory.

Parents also serve on a hardware committee that advises DiGiammarino on

tape'n text

The following instructional audio cassette tape courses are being used in over 500 public schools and colleges. A review in The Mathematics Teacher cited Tape 'N Text as "good, bright, and cheery. Development is well done." Each title includes 4 cassette tapes and 4 printed texts:

Programming in BASIC	$19.95
Intermediate BASIC	$19.95
Advanced BASIC	$19.95
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A catalog of recent software, programs sent with each order.

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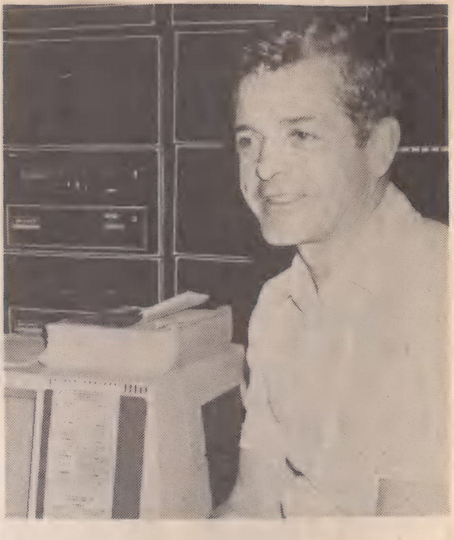
equipment purchases and helps solve hardware problems.

Lexington has a service contract with DEC to cover breakdowns of the central units. "Downtime is somewhat of an issue," said DiGiammarino. "We do all our finances and budgeting on the PDP-11/40. Once the service people get here, they can't leave until the machine is up and running. I don't see how people can operate without the kind of contract that can push DEC to the wall if need be. We don't hesitate to push when necessary."

An in-house maintenance man who trained at New England Electronics Company, the local PET distributer, repairs the microcomputers. With the in-house expertise, Lexington gets faster and more efficient turn-around time than they would if they sent the machines out for repair.

All this computer activity requires careful planning. DiGiammarino refers to Lexington's "programatic approach." "We get the staff to specify the kinds of uses it wants and the hardware committee to help decide on equipment. To use computers wisely, you need to have everything up front: What do you want to do? What does it cost? Where is the money going to come from? Our school committee has been very perceptive and challenged us to come up with a five year plan."

Right now, Lexington plans annually for its computer operations and instructional program. In the elementary schools, a committee of teachers, specialists and resource people carries out this planning effort. A teacher who wants to use the computer in a new way can approach the planning group to obtain resources to carry out the project. Recently, for example, a teacher developed a writing program for second and fifth graders that uses text editors. When a project is completed, the teacher is expected to "export" the model to other teachers.



Dr. Frank DiGiammarino

Faculty training occurs in several other ways: The district holds regular professional development workshops; it offers a one semester programming course and one-shot, hands-on workshops, in which instructors bring several micros to the staff at individual schools. Beth Loud also provides individualized training at the curriculum resource center.

This October, interested staff and central office personnel can attend a one-and-a-half day in-house computer conference. The conference will feature the exporting idea. "We're hoping for a ripple effect from this conference," DiGiammarino said. "People who attend will share ideas and information with others on the staff."

DiGiammarino remarked that the teachers were really wrestling with how to use the computer effectively. "They realize there's something more here than just an audiovisual aid."

Teachers sign computers out to take home for the weekend. Some have bought their own. One teacher is managing his class's reading skills program with a microcomputer; others are using text-editors and printers to stimulate student writing.

"We're moving teachers closer to the professional role of teaching, which is diagnosis-prescription-evaluation — like a doctor," said DiGiammarino. "It's the ultimate effect of the computer."

Bruce Wellman is an elementary school teacher and a free-lance photojournalist.

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WHEN THE KIDS ASK . . .

What Is a Microprocessor?

by Lloyd R. Prentice

It's not a Cuisinart for midgets.

It's a remarkable electronic device — the heart of every small computer. It's smaller than your thumbnail and it's made out of purified sand, but without it you wouldn't be able to add or subtract on your Apple, type a program into your TRS-80 or play *Adventure* on your PET.

Indeed, it may be one of the most versatile inventions ever, this microprocessor. It's certainly right up there with fire, the wheel and writing paper in the general usefulness department.

A microprocessor is an electronic circuit etched into a single chip of silicon crystal that helps you process numbers. It can add or subtract two numbers; compare two numbers and tell you which, if either, is the larger; replace one number with another; memorize a number for later use and recall it at the proper time. "Aha!" you say. "That's just an ol' pocket calculator." You're close, but there's a difference that makes all the difference between a pocket calculator and a microprocessor.

The useful thing about this number manipulating machine called a microprocessor is that it opens up the whole realm of counting and measuring. You can do most any mathematical calculation with such a machine, including simple logic of the IF . . . THEN . . . ELSE . . . variety. You can even define the numbers you're working on as letters of the alphabet or elements of a visual image or notes in a musical scale. So with a microprocessor, you can calculate a batting average, edit a misbegotten sentence, animate the image of a butterfly or play *Stars and Stripes Forever* — indeed, you can process information of every sort.

"Whoa!" you say. "How can such a simple machine do such amazing things?"

The fact is that most complicated tasks can be broken down into simple logical operations. In fact, the simplest microprocessor provides a sufficient variety of logical operations to do an infinite number of useful things like play the game of NIM, simulate a lunar lander or practice irregular verbs. But you do need to execute these operations in a proper sequence to do a given job. A simple game like NIM might require several thousand add, subtract, compare, change, save or recall operations, all executed in precise sequence. A good simulation might require tens of thousands of such operations.

So now you see the "gotcha" in the pocket calculator concept. The calculator can certainly carry out all of the logical operations that you need to do useful chores. But to execute each operation you need to press the proper keys. To play a rousing game of NIM, with its thousands of logical operations, you'd be banging keys forever — provided you could remember which keys to push and when.

Well, suppose you write out a list of all the logical operations needed to turn your microprocessor into a nimble NIM player. And suppose you give each operation a number so that by following the numbers you also follow the correct sequence of logical operations needed to play NIM. Now all your microprocessor needs to do to play the game is follow the numbers, and read and carry out the instructions. By writing down the instructions, you've "programmed" the microprocessor to function as a NIM-playing machine. Change the instructions and your microprocessor can simulate a lunar lander or help you practice French grammar or perform countless other useful chores.

> ***The microprocessor is like a faithful clerk, carrying out instructions one after another until it comes to an instruction that says halt.***

Computer engineers have yet to devise a microprocessor that can follow a program on paper, however. A microprocessor has to be wired into a computer system, and you must enter your program into the computer's electronic memory. Each memory location can store either an instruction to the microprocessor or an item of information to be processed. Each location also has a unique address. Computer memory is like a bank of post office boxes. To find a box you read the numbers on the front. When you've found the box you want, you can open it to see what's inside.

A microprocessor locates a particular memory cell in much the same fashion. A counter, not unlike a counter on a subway turnstile, tells the microprocessor which memory location to examine. The number on this counter corresponds to the address of the memory cell that the processor is to look at. The processor sends this address out to memory along with a signal that says, "I want to read the contents of this particular memory location." The memory then sends back the information found in that particular address. If the information is a program instruction, the processor then carries it out — adds, subtracts, compares or what not. The process of fetching an instruction and carrying it out is called an instruction cycle. At the completion of an instruction cycle, the processor adds one to the program counter and starts all over again.

Generally the microprocessor carries out each instruction as it comes to it in the computer's memory. But the processor has one very useful trick up its sleeve. Certain instructions cause it to change the value of its internal program counter. These are called jump instructions. If the processor is executing instruction number 200 and that instruction says to change the value of the program counter to 10, the processor will "jump" to memory location 10 and start fetching instructions from that point. And better yet, the jump can be conditional — that is, the processor will change its internal program counter only if a certain condition is true: "If the letter 'Y' is found in memory location 50 then jump back to the beginning of the NIM-playing program, or else tell the folks goodbye, you very much enjoyed the game."

Still other instructions cause the microprocessor to store information in the computer's memory. The processor simply sends out the correct memory address along with a signal that says, "I've got something to save," before passing the data on to memory.

So that's the life of a microprocessor — fetch an instruction, execute it, increment the program counter and start all over again. The microprocessor is like a faithful clerk, carrying out instructions one after another until it comes to an instruction that says halt. This clerk can only do what you tell him, but he's very fast. A typical microprocessor can carry out several million instruction cycles a second. Given the proper instructions, even the humblest microprocessor can play a wizard game of NIM. That isn't bad for an electronic component that's smaller than your thumbnail, made of purified sand and that costs as little as a quality paperback novel.

Lab Assistant

Elementary science experiments for the Apple

by Nancy Kraft

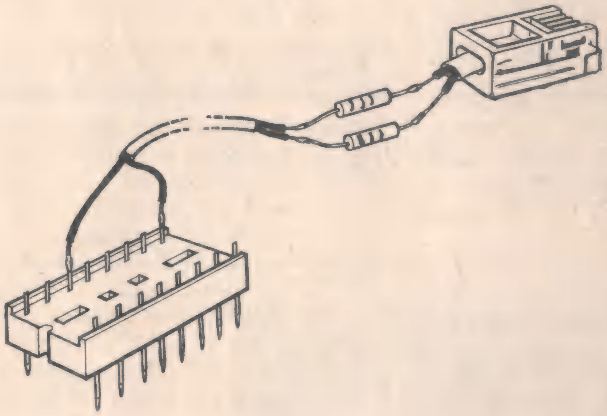
With a simple program and some easy-to-construct hardware, the elementary school teacher can use the computer in unstructured, open-ended experiments that help students learn about temperature and light. Even if you can't program and don't understand electronics, you can use the following program. You may want the help of someone who has these skills, but only to get started.

The program, as written in floating point BASIC (Applesoft), measures temperature and/or light and plots these on a high resolution graph. When run, it gives immediate feedback in the form of a white line moving horizontally and vertically across the screen. The plotting line moves slowly for easy observation. When the screen is filled, it automatically clears for a new test and plotting line.

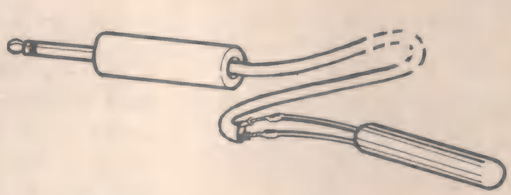
You'll need three pieces of hardware for the light and temperature experiments: a light sensor, a temperature sensor and a plug with which to attach the sensors to the game paddle socket of the Apple computer. Instructions for assembling the hardware and the software program appear in the accompanying boxes.

Applications for this program are endless. The following sequence of activities is just a suggested starting point.

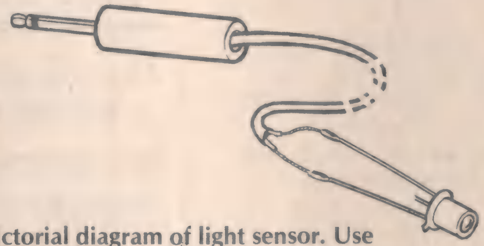
HARDWARE



Pictorial diagram of game paddle plug and sensor input jack. See Apple reference manual for game paddle connection details.



Pictorial diagram of temperature sensor



Pictorial diagram of light sensor. Use Radio Shack RS276-130 photo transistor.

To make a plug for the game paddle socket

Materials:
1 pair 12-inch hook up wires
1 16-pin DIP (Dual Inline Plug) header
1 150K ohms resistor
1 15K ohms resistor
1 miniature earphone jack

First, solder the 12-inch hook up wires to pin #1 (main computer power supply) and pin #6 on the 16-pin DIP header (the plug for the game socket). Pin #6 is the paddle 0 input pin. If another sensor were to be used, an additional pair of wires would be soldered to pin #1 and pin #10, 7 or 11. Since pin #1 is the power source, it is always used with a second pin.

Solder the two small resistors onto the other ends of the hookup wires and solder the resistors to the miniature earphone jack.

Insert the plug into the "Game I/0" socket in the Apple.

To make a light sensor

Materials:
1 photo transistor
1 audio extension cord with plug end (about 1 meter)
1 protector (old plastic pen case) for transistor
Heat sink compound (silicone)

Solder the loose wire ends to the photo transistor. (The round, flat part senses light.) To protect against breakage, enclose the sensor in a discarded pen case; surround with heat sink compound to prevent vibration.

To make temperature sensor

Materials:
1 thermistor 135K ohms (available through Fenwal Electronics, Framingham, Mass.
1 audio extension cord with plug end (about one meter)
1 protector for thermistor, preferably metal

Solder the two loose wire ends to the two thermistor wires, being careful not to break the glass. (The thermistor is a device that has a resistance which changes as it heats or cools.) Enclose the sensor in a metal case which will quickly conduct temperatures — a mechanical pencil works well.

Temperature

Materials:
- Tap water (cold, hot)
- Milk (cold, hot)
- Chocolate (liquid or instant powder)
- Food coloring
- Ice cubes (some with and some without bubbles
- Crushed ice
- Dry ice
- Ice cream
- Temperature sensor attached to Apple computer

First measure the following, one at a time, to become familiar with the equipment:
- Air
- Breath
- Water (tap, iced)
- Ice
- Milk (cold)

Insert the temperature sensor into the medium (There is no chance of shock). Wait briefly while the temperature registers. If comparing mediums, move on relatively quickly to get the sharpest visible contrast on the screen.

Proceed with these comparisons:
- Tap water and iced water
- Tap water and hot water
- Iced water and hot water

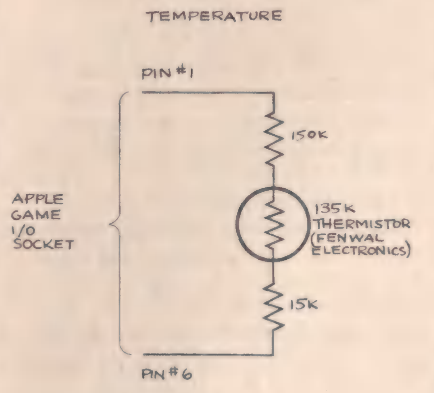
- Cold milk and iced milk
- Iced water and iced milk
- Hot water and hot milk

- Tap water with chocolate and cold milk with chocolate*
- Iced water with chocolate and iced milk with chocolate
- Hot chocolate water and hot chocolate milk

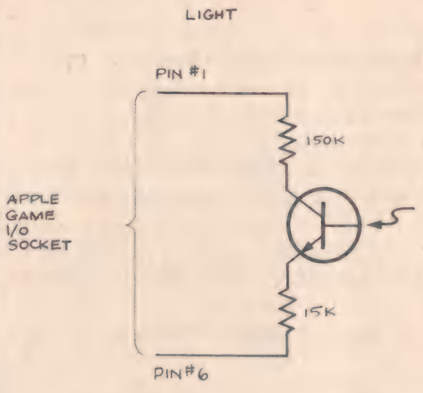
- Colored* iced water and uncolored iced water
- Ice cubes with bubbles and ice cubes with no bubbles
- Ice cubes and crushed ice
- Dry ice and ice cube
- Ice cube and ice cream

Questions to explore using the temperature sensor

- Does the shape, size or color of an ice cube affect the temperature?
- Which liquid cools fastest? Water, liquid soap, cooking oil, vinegar, salt water, milk, orange juice.
- Does temperature vary as you get farther from the heat source?
- When these metals are dipped into hot water (cold water), do they register the same temperature? Brass, copper, silver, aluminum. How about wood, glass, plastic?
- Is air touching a warmer object heated by conduction?
- Is warm air pushed up by cold air?
- Do cold liquids behave differently from warm liquids?
- Do some metal wires heat faster than others?
- Do all people have the same hand temperature?



Schematic diagram of temperature sensor



Schematic diagram of light sensor

Light

Materials:
- 4 or 5 small mirrors
- Table lamp with lampshade and 3-way switch
- 3-way bulb
- Battery flashlight
- Flashbulb for camera
- Strobe light for camera
- Food-warming candle

Begin by moving the sensor through the air, noting the changes on the screen. Create conditions of more light and of less light.

Comparisons in light intensity:
- Classroom electrical lights and indirect sunlight
- Indirect sunlight and direct sunlight
- Direct sunlight and classroom electrical lights
- Firing of flashbulb without classroom lights and firing of flashbulb with classroom lights
- Flashbulb and flashlight
- Flashlight and strobe light
- Flashlight and food-warming candle
- Food-warming candle and same with small mirrors surrounding it
- Table lamp with 3-way bulb (Measure and compare each strength)
- Table lamp with and without lamp shade

Questions to explore using the light sensor

- Does the length of the wire in a circuit affect the brightness of the bulb?
- At what part of the school day is the sunlight brightest in the classroom?
- At what part of the school day is the total light intensity highest in the classroom?
- How does light intensity vary as you get farther from the source?
- Does a lightbulb with broken glass emit the same amount of light as before?
- Will adding another battery to some bulbs increase brightness?

This program also dovetails with McGraw-Hill *Science Study Units.* Appropriate units are:
- Match and Measure, Grades K-3
- Drops, Streams, and Containers, Grades 3-4
- Ice Cubes, Grades 3-5
- Batteries and Bulbs, Grades 4-6
- Optics, Grades 4-6
- Heating and Cooling, Grades 5-7
- Kitchen Physics, Grades 6-7

In addition, the game plug can accomodate up to four measuring circuits simultaneously. My next step will be to experiment with more than one sensor and with different colored graphs for each sensor.

SOFTWARE

Listing of the program in Applesoft

```
 10 TIM = 1000
 20 HGR
 30 HCOLOR = 3
 40 POKE 16302,0
 45 HPLOT 0,. 76* (PDL(0) -5)
 50 FOR X =1 to 279
 60 HPLOT to X, .76* (PDL(0) -5)
 70 FOR I = 0 to TIM
 80 NEXT I
 90 NEXT X
100 GO to 20
110 END
```

Nancy Kraft is an elementary school teacher. Staff at Technical Education Research Centers (TERC), Cambridge, Mass., provided the inspiration for her project and help with developing the hardware and the software.

---

*Use substantial and equal amounts in each medium.

Beyond the Electronic Workbook

by Susan Jo Russel

Controversy already surrounds the use of computers in mathematics education, and most of it centers on the "electronic workbook" syndrome. Use of a computer to generate and correct arithmetic problems and/or to record and monitor the student's progress may have its place. It is certainly efficient, quick and nonjudgmental; it relieves the teacher of certain burdens. Furthermore, proponents say that children like it.

While such uses have apparent value, using the computer exclusively for tasks that other tools can do as well cannot only narrow our own vision, but also limit our children's understanding of the scope, the power and the uniqueness of this tool. Moreover, we may let the computer lead us toward a reduction rather than an enchancement of the use of mathematics in schools.

In reducing mathematics to a series of "skill bits" to be taught and tested, we leave children with a catalog of underutilized techniques, without concept or context. They cannot generalize, expand, interconnect or apply what they know. The National Assessment of Educational Progress' second round of mathematics testing indicates that school-aged children's lowered math scores may stem from an inability to apply arithmetic procedures appropriately, not from a deficiency in computational techniques. Yet much of the present mathematics curriculum emphasizes computation, and our first thoughts about computer applications have focused on arithmetic operations.

Teaching Other Skills

We can — and should — use the computer to teach other math skills. In 1977, the National Council of Supervisors of Mathematics listed ten basic skills in mathematics. Appropriate computational skills is only one of the ten. The others are well worth listing, since they provide a new view of basics, geared to the mathematical skills we need to survive in the world. They are: problem solving, applying mathematics to everyday situations, ability to judge the reasonableness of results, estimation and approximation, geometry, measurement, use of graphs and charts, use of mathematics to predict, and computer literacy. The use of computers in mathematics education should reflect the range of these objectives and should emphasize problem-solving of many types, not just arithmetic.

Estimation is one of the neglected areas of the curiculum. In the classroom, I've always had difficulty setting up estimation situations involving numeric computation (as opposed to estimation of length or quantity) that did not seem contrived. This is a perfect use for the computer.

Take a common situation in which the student can use estimation: Do I have enough money to buy what I want? Use the computer to vary the prices, the quantities and the items involved as well as the time allotted to make the decision; allow the student to choose an appropriate level of challenge and to participate in personalizing the problems; allow for clear feedback without judgment.

If we only use computers as electronic workbooks, they may lead toward a reduction rather than an enhancement of the use of mathematics in schools.

The program, written in Level II BASIC for a TRS-80, presents problems in the following format:

*** IRWIN'S PRICES ***	
Magnet	$ .49
Puzzle	$ .59

Sue wants to buy one magnet and one puzzle.

Sue has $1.00.

Does Sue have enough?

The program, called *Quick Thinking*, presents three levels of problem difficulty. Price range for each item and amount to be spent increase at each level. At level one, the user considers buying only one of each item; at levels two and three, the user may consider one or two of each item. In addition, the program allows three time options. The first gives the user about nine seconds to respond from the time the final question appears, the second about seven seconds and the third about five.

The computer automatically supplies instructions and starts at level one if the user answers no to the question "Have you ever played *Quick Thinking* before?" which begins the exercise. Otherwise, the user may select the problem level. Within each level, the user begins at speed one and can choose to increase the speed if he or she answers at least eight out of ten problems correctly.

Susan Jo Russel was a classroom teacher for eight years. She is currently a staff developer for the Cambridge Public Schools, Cambridge, Mass., and an adjunct faculty member at Lesley College, Cambridge, Mass.

The *Quick Thinking* Program

```
10 REM  ###  CONTROL MODULE--"QU
ICK THINKING"  ###
20 REM
25 CLEAR 200
30 DIM PA$(5),PB$(7),PC$(5),PD$(
5),PE$(7),PF$(7),N$(4)
50 REM---READ IN DATA (NAMES OF
ITEMS)
60 FOR I=1 TO 5:READ PA$(I):NEXT
 I
70 FOR I=1 TO 7:READ PB$(I):NEXT
 I
80 FOR I=1 TO 5:READ PC$(I):NEXT
 I
90 FOR I=1 TO 5:READ PD$(I):NEXT
 I
100 FOR I=1 TO 7:READ PE$(I):NEX
T I
110 FOR I=1 TO 7:READ PF$(I):NEX
T I
120 REM---TITLE
130 CLS
140 PRINT @ 401,"Q U I C K   T H
 I N K I N G"
150 PRINT @ 531,"(ESTIMATING WIT
H MONEY)"
160 PRINT @ 776,"S.J.RUSSELL":PR
INT @ 818,"7-14-80"
170 FOR I=10 TO 117:SET(I,6):NEX
T I
```

```
180 FOR I=7 TO 40
190  SET(10,I):SET(11,I):SET(116
,I):SET(117,I):NEXT I
200 FOR I=10 TO 117:SET(I,40):NE
XT I
210 REM---WASTE TIME
220 FOR I=1 TO 1000:NEXT I
230 REM---INSTRUCTIONS REQUIRED?

240 CLS
250 PRINT:PRINT:PRINT"WELCOME TO
 QUICK THINKING"
255 INPUT "PLEASE TYPE IN YOUR N
AME";N$(1)
260 PRINT:PRINT "HAVE YOU PLAYED
 'QUICK THINKING' BEFORE?"
270 INPUT "PLEASE ANSWER YES OR
NO";EP$
280 IF EP$="NO" THEN 360 ELSE IF
 EP$="YES" THEN 310 ELSE 270
310 INPUT "DO YOU WANT TO BE REM
INDED HOW TO PLAY";A$
320 IF A$="NO" THEN 370 ELSE IF
A$="YES" THEN 360
330 PRINT "PLEASE ANSWER YES OR
NO.":GOTO 310
360 GOSUB 600
370 REM---GET NAMES TO USE IN PR
OBLEMS
380 CLS:PRINT:PRINT:PRINT:PRINT
390 PRINT "TO HELP THE COMPUTER
SET UP THE PROBLEMS,"
400 PRINT "PLEASE TYPE IN THE NA
MES OF THREE PEOPLE YOU KNOW."
410 INPUT "    FIRST NAME";N$(2)

420 INPUT "    SECOND NAME";N$(3
)
430 INPUT "    THIRD NAME";N$(4)

440 REM---SET SPEED TO SLOWEST
450 SL=1
460 REM---IF NEVER PLAYED,EASIES
T PROBLEM SET,
470 REM          ELSE USER CHOOSE
S LEVEL OF DIFFICULTY
480 IF EP$="NO" THEN PL=1 ELSE G
OSUB 800
490 REM---BEGIN PROBLEMS
500 PRINT:INPUT "WHEN YOU ARE RE
ADY FOR YOUR FIRST PROBLEM, PRES
S ENTER";A$
510 GOSUB 1200
520 REM---USER CHOOSES MORE PROB
LEMS OR ENDS
```

```
530 PRINT:PRINT "YOU ESTIMATED C
ORRECTLY FOR "CA" OUT OF 10 PROB
LEMS.":PRINT
540 IF SL=3 AND PL=3 AND CA>8 TH
EN PRINT "YOU HAVE DONE THE HARD
EST PROBLEM SET AT THE FASTEST S
PEED.":INPUT "DO YOU WANT TO DO
ANOTHER SET";A$:IF A$= "YES" THE
N 500 ELSE 4999
550  IF CA>8 AND SL<3 THEN PRINT
 "YOU DID A TERRIFIC JOB OF ESTI
MATING.":PRINT "WOULD YOU LIKE T
O TRY SOME":INPUT " WITH A SHORT
ER TIME LIMIT FOR EACH PROBLEM";
A$:IF A$="YES" THEN SL=SL+1:GOTO
 500 ELSE 4999
560  IF CA>8 AND SL=3 THEN PRINT
 "YOU HAVE DONE THIS SET OF PROB
LEMS WITH THE SHORTEST TIME LIMI
T.":INPUT "WOULD YOU LIKE TO TRY
 A HARDER SET OF PROBLEMS";A$:IF
 A$="YES" THEN PL=PL+1:SL=1:GOTO
 500 ELSE 4999
570  IF CA<9 THEN PRINT "YOU COU
LD USE SOME MORE PRACTICE ON THE
SE PROBLEMS.":INPUT "WOULD YOU L
IKE TO TRY SOME MORE";A$:IF A$=
"YES" THEN 500 ELSE 4999
600 REM  ###  INSTRUCTIONS SUBRO
UTINE  ###
610 CLS
620 PRINT:PRINT "THE OBJECT OF '
QUICK THINKING' IS TO MAKE "
630 PRINT "QUICK DECISIONS ABOUT
 MONEY."
640 INPUT "HERE IS AN EXAMPLE (P
LEASE PRESS ENTER)";A$
650 IA$="PENCIL":IB$="PEN":IC$="
 ":PA=.15:PB=.29
660 NU$=N$(1):QA=1:QB=4:AT=1
670 GOSUB 900
680 INPUT A$
690 IF A$="YES" THEN 720 ELSE IF
 A$="NO" THEN 740
700 PRINT "YOU HAVE TO TYPE 'YES
' OR 'NO'."
710 PRINT "HERE IS THE PROBLEM A
GAIN.":GOTO 730
720 PRINT "LOOK AT THE PROBLEM C
AREFULLY AGAIN."
730 INPUT "(PLEASE PRESS ENTER)"
;A$:GOTO 650
740 CLS:PRINT "RIGHT!":PRINT
750 PRINT "ALL THE PROBLEMS ARE
LIKE THIS,"
```

```
760 PRINT "BUT YOU ONLY HAVE A S
HORT TIME TO ANSWER."
770 PRINT "TRY TO ESTIMATE AS QU
ICKLY AS YOU CAN."
780 PRINT "THERE ARE 10 PROBLEMS
."
790 INPUT "PRESS ENTER WHEN YOU
ARE READY TO CONTINUE";A$
795 RETURN
800 REM   ###  PROBLEM LEVEL SEL
ECTION  ###
805 CLS
810 PRINT:PRINT:PRINT:PRINT
820 PRINT "THERE ARE 3 SETS OF P
ROBLEMS."
830 PRINT:PRINT "     SET 1 IS H
ARD."
840 PRINT "     SET 2 IS HARDER.
"
850 PRINT "     SET 3 IS HARDEST
!"
860 PRINT:PRINT "WHICH PROBLEM S
ET DO YOU WANT TO TRY?"
870 INPUT "PLEASE TYPE 1, 2, OR
3";PL
880 IF PL<>1 AND PL<>2 AND PL<>3
 THEN 870 ELSE RETURN
900 REM   ###  PROBLEM SET-UP SU
BROUTINE ###
905 CLS
910 PRINT @ 146,"###  IRWIN'S PR
ICES  ###"
920 PRINT @ 299,"$":PRINT @ 266,
IA$
930 IF PA<1 THEN PRINT @ 302,PA
ELSE PRINT @ 301,PA
935 IF PA-INT(PA)=0 THEN PRINT @
 303,".00"
937 IF PA*10-INT(PA*10)=0 THEN P
RINT @ 305,"0"
940 PRINT @ 363,"$":PRINT @ 330,
IB$
950 IF PB<1 THEN PRINT @ 366,PB
ELSE PRINT @ 365,PB
955 IF PB-INT(PB)=0 THEN PRINT @
 367,".00"
957 IF PB*10-INT(PB*10)=0 THEN P
RINT @ 369,"0"
960 IF IC$=" " THEN 990
970 PRINT @ 427,"$":PRINT @ 394,
IC$
980 IF PC<1 THEN PRINT @ 430,PC
ELSE PRINT @ 429,PC
985 IF PC-INT(PC)=0 THEN PRINT @
 431,".00"
```

```
987 IF PC*10-INT(PC*10)=0 THEN P
RINT @ 433,"0"
990 FOR I=10 TO 117:SET(I,3):SET
(I,23):NEXT I
1000 FOR I=4 TO 22:SET(10,I):SET
(11,I):SET(116,I):SET(117,I):NEX
T I
1010 FOR I=1 TO 500:NEXT I
1020 IF QA>1 THEN IA$=IA$+"S"
1030 IF QB>1 THEN IB$=IB$+"S"
1040 IF QC>1 THEN IC$=IC$+"S"
1050 IF IC$<>" " THEN 1080
1060 PRINT @ 581,NU$" WANTS TO B
UY "QA" "IA$" AND "QB" "IB$"."
1070 GOTO 1100
1080 PRINT @ 581,NU$" WANTS TO B
UY "QA" "IA$", "
1090 PRINT @ 645, QB" "IB$", AND
 "QC" "IC$"."
1100 FOR I=1 TO 500:NEXT I
1110 PRINT @ 709,NU$" HAS $ "AT"
.00."
1120 FOR I=1 TO 500:NEXT I
1130 PRINT @ 773,"DOES "NU$" HAV
E ENOUGH MONEY? (ANSWER YES OR N
O)"
1140 RETURN
1200 REM  ***  PROBLEM CONTROL *
**
1205 CA=0
1210 FOR J=1 TO 10
1220 A$=""
1230 ON PL GOSUB 1500,2000,2500
1240 GOSUB 900
1250 GOSUB 1400
1255 FOR I=1 TO 200:NEXT I
1260 CLS:GOSUB 1300
1270 PRINT:PRINT
1280 IF J<10 INPUT "WHEN YOU ARE
 READY FOR THE NEXT PROBLEM,PRES
S ENTER";A$
1290 NEXT J
1295 RETURN
1300 REM----CHECKANSWER SUBROUTI
NE
1305 PRINT:PRINT:PRINT
1310 TC=(PA*QA)+(PB*QB)+(PC*QC):
AR=AT-TC
1320 IF (A$="Y" AND AR>=0) OR (A
$="N" AND AR<0) THEN 1360
1330 IF A$="" THEN PRINT "OUT OF
 TIME ON THAT ONE.":GOTO 1370
1340 PRINT "NO. THE TOTAL COST W
AS $ "TC" AND "NU$" HAD $ "AT".0
0."
1350 GOTO 1370
1360 PRINT "THAT'S RIGHT.":CA=CA
+1
1370 RETURN
1400 REM---TIME COUNTER
1410 ON SL GOTO 1420,1430,1440
1420 N=1000:GOTO 1450
1430 N=750:GOTO 1450
1440 N=500
1450 FOR I=1 TO N
1460 A$=INKEY$:IF A$="" THEN NEX
T I
1461 IF A$="" THEN 1470
1462 PRINT A$;:IF A$="N" THEN 14
66
1464 B$=INKEY$:IF B$="" THEN 146
4
1465 PRINT B$;
1466 C$=INKEY$:IF C$="" THEN 146
6
1467 PRINT C$
1470 RETURN
1500 REM---PROBLEM LEVEL 1
1510 IF J>5 THEN AT=RND(2)*5 ELS
E AT=1
1520 QA=1:QB=1:QC=0:W=RND(4):NU$
=N$(W)
1530 IF J>5 THEN 1600
1540 R=RND(5):IA$=PA$(R)
1550 S=RND(5)
1560 IF S=R THEN 1550 ELSE IB$=P
A$(S)
1570 IC$=" "
1580 PA=(RND(6)+1)*.1+.09
1590 PB=(RND(6)+1)*.1+.09:GOTO 1
670
1600 R=RND(7):IA$=PB$(R)
1610 S=RND(7)
1620 IF S=R THEN 1610 ELSE IB$=P
B$(S)
1630 T=RND(7)
1640 IF T=S OR T=R THEN 1630 ELS
E IC$=PB$(T)
1650 PA=(RND(299)+100)*.01:PB=(R
ND(299)+100)*.01
1660 PC=(RND(299)+100)*.01:QC=1
1670 RETURN
2000 REM---PROBLEM LEVEL 2
2010 QA=RND(2):QB=RND(2):PC=0:IC
$=" "
2020 W=RND(4):NU$=N$(W)
2030 R=RND(5)
2040 S=RND(5)
2050 IF S=R THEN 2040
2060 IF J>5 THEN 2120
2070 AT=RND(5)
2080 IA$=PC$(R):IB$=PC$(S)
2090 PA=(RND(111)+20)*.01
2100 PB=(RND(111)+20)*.01
2110 GOTO 2160
2120 AT=RND(2)*5
2130 IA$=PD$(R):IB$=PD$(S)
2140 PA=(RND(299)+100)*.01
2150 PB=(RND(299)+100)*.01
2160 RETURN
2500 REM---PROBLEM LEVEL 3
2510 W=RND(4):NU$=N$(W):R=RND(7)

2520 S=RND(7)
2530 IF S=R THEN 2520
2540 T=RND(7)
2550 IF T=R OR T=S THEN 2540
2560 IF J>5 THEN 2640
2570 AT=RND(3)*5
2580 IA$=PE$(R):IB$=PE$(S):IC$=P
E$(T)
2590 PA=(RND(299)+100)*.01
2600 PB=(RND(299)+100)*.01
2610 PC=(RND(299)+100)*.01
2620 QA=RND(2):QB=RND(2):QC=RND(
2)
2630 GOTO 2740
2640 X=RND(3)
2650 ON X GOTO 2660,2670,2680
2660 AT=20:GOTO 2690
2670 AT=25:GOTO 2690
2680 AT=50
2690 IA$=PF$(R):IB$=PF$(S):IC$=P
F$(T)
2700 PA=(RND(701)+290)*.01
2710 PB=(RND(701)+290)*.01
2720 PC=(RND(701)+290)*.01
2730 QA=RND(2):QB=RND(2):QC=RND(
2)
2740 RETURN
4999 PRINT:PRINT "THEN THAT'S AL
L, "N$(1)".":END
5000 DATA "PENCIL","BOX OF CRAYO
NS","MAGNET","DICE","PUZZLE"
5010 DATA "WATERCOLOR SET","MAGN
IFYING GLASS","BOOK"
5020 DATA "MODEL CAR","NOTEBOOK"
,"DECK OF CARDS","BALL"
5030 DATA "MAGIC MARKER","MAGNET
","MODEL CAR","PUZZLE"
5040 DATA "HARMONICA","BOOK","WA
TERCOLOR SET","NOTEBOOK"
5050 DATA "CHECKER GAME","FRISBE
E","PAINT SET","BOOK"
5060 DATA "BAG OF MARBLES","MAGN
IFYING GLASS","DECK OF CARDS"
5070 DATA "YO-YO","FRISBEE","TED
DY BEAR","MODEL AIRPLANE KIT"
5080 DATA "CHECKER & CHESS SET",
"BALL","MAGIC MARKER SET"
5090 DATA "JIGSAW PUZZLE","BOOK"
```

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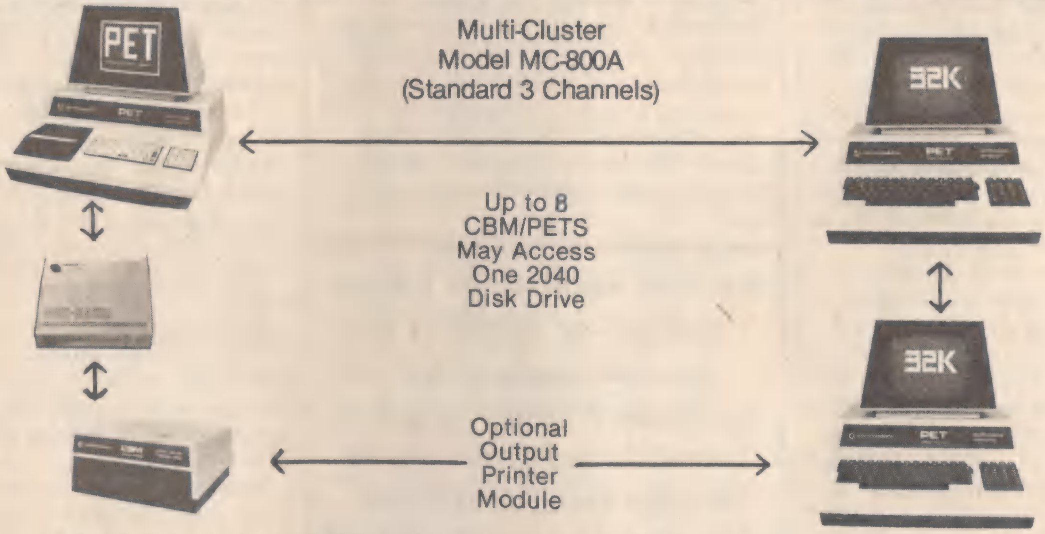

Multi-Cluster is ideal for industrial, OEM, Vertical Markets, and Educational Institutions. Multi-Cluster allows you to make full use of the Commodore 3 units for the price of 2 educational programs.

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1	Multi-Cluster	#MC800A
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3	6′ Ribbon Cables	#RC6

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Each additional CM-100	$250
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*PET is a registered trademark of Commodore Business Machines. Small Keyboard PETS require a ROM Retrofit Kit for Multi-Cluster system operation.

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Discs: The Information Storage Medium of the '80s

by Katharine Gardner Cipolla

Whenever computer people talk to other people, the word "disc" crops up. But the disc the computer person means is probably not the one the listener understands. A term that once referred only to audio recordings now has quite varied meanings for consumers, librarians, instructional designers and computer experts. Discs are the information storage medium of the '80s.

After Edison's invention made possible the sound recording industry, with which much of the world associates discs, IBM started using magnetic discs as a computer information storage medium. The discs used much of the technology developed for magnetic tape storage, the medium they began to replace.

Two types of storage discs are now commonly used: floppy and rigid. Floppy (8" diameter) and mini-floppy (5¼") discs are flexible mylar sheets coated with iron oxide. The reading head touches the disc surface much as a stylus touches a phonograph record to pick up recorded information. Like phonograph records, floppies are prone to wear and noise caused by heavy use and dust. The disc spins relatively slowly and, because mylar can expand unevenly with heat, the tracks are fairly wide (1/48"); this combination results in a relatively low density storage medium, about one to 20 million bits per disc. One million bits of information is roughly equal to 80 double-spaced typewritten pages.

Rigid discs store more information than floppy discs. While the user can remove the floppy from its reader, the rigid disc is sealed into a clean environment, where dust is filtered out. The disc is rigid aluminum, 8" or 14" in diameter, coated on both sides with magnetic film. The disc rotates at a very high speed, with a track width of 1/1000". In its sealed box, the disc is read or recorded by a magnetic head floating just above the surface of the disc. No contact occurs and, therefore, no wear. Errors are reduced to one in 10 billion bits, and data capacity is increased by billions of bits for high performance discs.

The still-experimental optical disc data storage systems are yet another category of disc technology. These discs store computer data and visual images with equal ease — indeed, the difference is significant only when the information is processed and displayed, not when it is stored.

Currently, optical discs are "read only" because recording involves using a finely focused gas laser to etch holes in a thin tellurium disc. The disc is sandwiched between protective layers of clear plastic. A lower power laser reads the finished disc. The sealing involves an industrial process which has so far made disc recording prohibitively expensive. With a storage potential in the 100 billion bit range, however, research continues.

One application of the optical disc is the videodisc system that Discovision Associates, a collaboration of IBM, Phillips and MCA, is marketing. The technology involved is exactly the same as for optical storage discs, except that a microprocessor translates the data into video signals. Also, the potential mass market lowers the unit cost of the pre-recorded discs.

> ***We may soon store library catalogs, or actual texts, on microprocessor-controlled optical discs to be retrieved and viewed on the same machines that play feature films and programmed instruction modules.***

Discovision's chief competitor is RCA's Selectavision. In this system, a microscopic, diamond-tipped stylus reads information in the disc's microgrooves. The disc is produced much like a phonograph record. A third design, promised by General Electric and JVC, will use a grooveless system in which a "shoe" will float on top of the smooth disc to pick up the signal.

Selectavision, first on the consumer market, has many of the wear problems of the floppy disc or phonograph record. It is also very prone to errors from dust; this is why the disc is not withdrawn from its protective sleeve until inside the player. Selectavision discs hold one hour of video signal per side, but, because of their grooves, they have no computer interface or random access potential.

Discovision, on the other hand, offers non-destructive playback; fingerprints, scratches or minor dust on the disc surface do not affect it. Its microprocessor-controlled random access feature makes it a natural choice for applications like programmed instruction and archival slide storage. For the consumer market, it offers stereo sound, freeze frame, multiple scanning speeds forward and reverse, and automatic frame stop, none of which is available from Selectavision. Its disadvantages are the higher price of a more sophisticated technology and video playback of only 30 minutes per side.

The third contender, from GE/JVC, will offer some of the microprocessor controlled features of Discovision with the addition of an optional "controller." It will offer longer stylus and disc life than Selectavision at a comparable price. But the GE/JVC unit is a year away from market.

At this time, at least two systems could coexist: Software producers are licensing distribution of their material in all formats. Perhaps, as with floppy and rigid discs, the various videodisc formats will settle into different submarkets.

Meanwhile, in the rarified atmosphere of the computer research and business machine industry, work proceeds on recordable, if not re-recordable, optical data storage discs. The effort will doubtless succeed and this technology will ultimately filter down to the industrial/educational market. We may soon store library catalogs, or actual texts, on microprocessor-controlled optical discs to be retrieved and viewed on the same machines that play feature films and programmed instruction modules.

Katharine Gardner Cipolla is the media services librarian for the Barker Library, Massachusetts Institute of Technology, Cambridge, Mass.

Getting Hard-nosed about Software

An educational software primer

by Frank Cristiano

A significant quantity of educational software is currently available, and the volume is rapidly expanding as publishers respond to educators' increasing interest in computing. As the amount of software grows, so does the need for good information with which to assess it. The following discussion of types of software, criteria for evaluation, software manufacturers and information resources provides guidelines for teachers and administrators integrating microcomputers into their classrooms and schools.

The Types of Educational Software

Educational software, sometimes called *courseware*, enables students to work with computers in an interactive way. Each piece of software provides pre-programmed instructions, written in a code specific to a particular computer (PET, TRS-80), that tells that computer to drill the student in math or spelling, to play a game that will test the student's reasoning ability — to do any of a countless number of things that will help the student learn.

Most educational programs fall into one of three common formats: games, skill programs and simulations. Computer games are probably the most widely publicized. Some are exact replicas of existing games such as checkers, backgammon or tic-tac-toe; some are modifications of traditional games which permit greater use of the computer's graphics and sound capabilities; yet others, such as the *Adventure* series, are unique to the computer. While the game format may be used in part to motivate the student, its primary educational objective is to develop logic and strategic thinking skills.

While game programs are most publicized, skill programs are most common. In skill programs, the computer asks the student a question, the student supplies an answer, and the computer responds, indicating whether the student's answer was correct. At that point, the program might provide clues to help the student modify his or her answer, or it might tabulate the student's score, providing feedback on how well he or she is doing. Some skill programs are more elaborate than this, however, and employ the special capabilities of the computer in ways that make lessons more appealing. This software is often called *computer-assisted instruction* (CAI). It covers such standard school curriculum areas as spelling, math, reading, history and geography.

Computer simulations offer an alternative to the more traditional approaches to skill programs. A computer simulation programs the computer to present a situation — the breakdown at Three Mile Island, for example — that has various possible outcomes — both desirable and undesirable. The student must manipulate certain variables — the amount of radioactive gas released, the number of valves open or shut — in an attempt to produce a desirable outcome, or avoid an undesirable outcome. The computer provides feedback on each decision the student makes.

Computer simulations may represent life situations, natural phenomena, historical events or imaginary environments. The Minnesota Educational Computing Consortium's (MECC) software library, for example, includes simulations that help students increase their understanding of environmental science, social history and cultural development. Their SELL series enables middle-grade students to investigate fundamental economic principles such as the relationship of profit to price and advertising. The Huntington Simulations, which isolate scientific phenomena for investigation, are another notable example of simulation programs. Many of these programs, originally written for high school and college students using large computers, are now available for microcomputers.

One last category of educational software — teacher authoring programs — deserves mention. This recent, rapidly growing addition to the software market is not for direct student use, but allows teachers to develop their own computer lessons simply and quickly. Authoring programs range from *Creative Computing's* "Study Made Easy," which provides teachers with a question-and-answer format in which they can insert any factual material, to the programming language Pilot, a language specifically developed for educators interested in writing their own computer lessons. Microcomputer versions of Pilot, including Bell & Howell's Genis I and Genis II and Apple's Appilot, are now available. While the authoring languages may allow teachers a degree of independence from the commerical software market, they are somewhat rigid in format and best suited to drill-and-practice structured lessons.

Software, Subject and Machine

You can reasonably expect that almost any curricular topic that can be converted to a question-and-answer format has been, or soon will be, integrated into a software package. Software distributors offer language skills lessons in spelling, vocabulary development, antonyms, analogies and basic reading skills, to list but a few. In mathematics, they offer lessons in basic computational skills as well as in the underlying concepts of place, value, factors, making change and telling time. History and geography facts have received as much attention; science and social studies have prompted a significant number of simulations as well as drill-and-practice lessons. Prices for software of the drill-and-practice type range from as low as five or six dollars for a cassette program containing a single lesson to 30 or 40 dollars for a package which includes a sequential presentation of related skills.

Of course, different amounts of software are available for different machines. According to *Purser's Magazine*, a directory of microcomputer software, more software is currently available for the TRS-80 than for any other microcomputer. For educational software specifically, however, the Commodore PET commands a slight lead because it has been in use the longest. Larger software developers and distributors, such as Program Design, Inc. and Micro Learningware, try to provide software for each of the popular microcomputers, (PET, TRS-80 Level II and Apple).

As a general rule of thumb, the larger the educational user group for a specific microcomputer, the greater the amount of available software. Therefore, as newer machines such as the Atari gain wider use, the amount of software available for them will increase. Also, a program distinguished by its popularity and effectiveness will, in all likelihood, become available in similar form for each of the microcomputers. The Pilot language and the *Adventure* series of computer games are two cases in point.

Evaluating Eduational Software

The most important questions to ask when evaluating educational software are, Does this software offer any advantages over other pedagogical methods? Does it effectively use the special capabilities of the computer to accomplish its educational objectives? If you can answer these satisfactorily, the program merits serious attention. You'll also want to assess the reliability of the software vendor, the adequacy of accompanying documentation and the actual format of the program.

Adequate documentation — for both teacher and student — is of utmost importance. Support materials should include not only operating instructions, but also statements of goals and objectives, information on prerequisite skills and concepts expected of the student, and suggestions for introducing, assisting and following up on the computer lesson. Where necessary, as with simulations, appropriate background information should be provided.

Teachers should also closely scrutinize aspects of the program format. Dialogue should be clearly presented and should maintain the student's interest. In particular, instructions telling the student how to interact with the computer should be clear; language should be within the student's reading level. Ample response to student input, clarification when students have problems, and easy entry and exit from the program are all important qualities to examine in a software program.

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Educational Software Producers

No one source currently dominates the educational software market. Microcomputer manufacturers, software companies, educational computing consortiums and individual teachers are all producing software.

The hardware manufacturers are using pre-packaged applications programs to make their machines more attractive. Atari, for example, produces an educational system called *Talk and Teach*, which includes programs in spelling, writing, algebra and computer programming; Radio Shack offers *Basic Computer Library*. We can expect microcomputer vendors to expand their educational software libraries rapidly.

Of the growing number of companies dedicated to developing and marketing computer software, some produce educational software exclusively, though most include business, technical and home applications programs in their repertoires. These producers range from individuals who create and distribute software from their homes to relatively large shops such as Program Design, Inc. and Microphys, which produce educational software in large quantities for each of the major microcomputers. Recently, several of the major educational materials publishers, including Scott Foresman, Scientific Research Associates (SRA) and Bell & Howell, have released computer software products. Some speculate that this may be an extensive enterprise in the near future. Many software houses, both large and small, will send product lists and descriptions in response to a written request.

Another valuable source of instructional software is the educational computing centers which have sprung up around the country. Membership in these regional consortiums usually includes school systems, universities and state education department representatives. The Minnesota Educational Computing Consortium is a well-established example of a regional cooperative that develops, tests and distributes educational software as part of its effort to help members effectively use computers. MECC maintains an extensive software library which includes programs in the major subject areas for students at all grade levels. Accompanying documentation provides information regarding objectives, teaching strategies and related resources. Project LOCAL in Westwood, Mass., and the Northwest Regional Education Laboratory in Oregon are other centers specifically interested in educational software.

Individual classroom teachers are also developing a significant amount of educational software. In some cases, school systems that have made firm commitments to educational computing support these efforts. The Robbinsdale Area Schools in Minnesota and the Lexington Public Schools in Massachusetts have both made teacher-developed software available to the public. In addition, many individual teachers have developed computer programs for their own classes. The Computer Education Resource Coalition (CERC), located at Lesley College, Cambridge, Mass., has begun to collect teacher-designed software with the intention of making it available to other teachers on an exchange basis.

Information Resources

Several periodicals provide information on educational software. *The Computing Teacher*, for example, offers descriptions of efforts around the country to apply microcomputers to classroom situations and reviews commercial software. *Purser's Magazine*, a software directory, provides listings of software distributors, reviews of educational software and an erudite editorial commentary by Robert Purser. Two other popular microcomputer periodicals, *Creative Computing* and *Recreational Computing*, also include software reviews. *Creative Computing* has a commitment to educational computing stemming from its own activities as a software developer and distributor.

The newsletters and publications of the various educational computer cooperatives are another valuable resource. Each of these groups reports on its own activities and publishes its reactions to developments in the field, including new educational software. MECC, the Association of Educational Data Systems (AEDS) and the International Council for Computers in Education (ICCE) — are three good information resources; Project LOCAL will publish an exhaustive listing of educational software this fall.

Improving Educational Software

While educational software abounds, the quality is uneven, and teachers are not often enough involved in its development. They need to be, and can be without becoming computer programmers. Teachers should agree on standards for educational software; they should make their standards known to commercial software producers. Teachers should collectively address such issues as the piecemeal nature of existing software and the over-emphasis on drill-and-practice programs. Their expertise should become integral to educational software development.

Frank Cristiano teaches in the Brookline Public Schools, Brookline, Mass.

Basic In A Nutshell

Name: Step-By-Step
Vendor: Program Design, Inc., 11 Idar Court, Greenwich CT 06830
Price: $49.95
Purpose: Teaches how to program a TRS-80 using BASIC
Documentation: Outstanding
Loading: OK – Level 6, not critical
Implementation: This is a case of a BASIC program that teaches BASIC programming. It starts out with the assumption that the student only knows how to turn the TRS-80 on. Three cassette tapes are mounted in the cover of a loose-leaf notebook that also contains supplementary information frames. The course is divided into ten two-part lessons. From a simple PRINT "HI" through arrays and graphics to complex programs, all of the Level II commands and statements are exercised.

The instruction method consists of explanation, example, trial and testing. Commands and statements are presented and explained, examples are shown both on the screen and in the notebook, and then the student is presented with some problems to solve using the BASIC elements under discussion. If an incorrect answer is given, two more tries are allowed, and then the correct answer is displayed. Each lesson ends with a test that is administered and scored by the computer. The results are then entered into the student's progress chart. More comprehensive examinations are given at the end of Lesson 5 and at the end of the course.

Suitability: This is the kind of educational programming that personal computing needs more of. The student (my teenage son) learned much more quickly than I could have taught him, and at his own pace. However, this course isn't just for youngsters but for anyone who wants to be able to program effectively using the BASIC language. In a household where there isn't anyone to do the teaching, this course would be especially useful. I'd like to see a similar course for assembly-language programming.

Other software available from the same vendor: IQ Builders (four different kinds), Memory Builder and Story Builder.

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80 Microcomputing, February 1980

Step by Step also available for Apple II and Pet   Apple II version also available on disks for $59.95.
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NEW PRODUCTS

Products briefs are written from manufacturers' announcements.

CBM Software for Administration

School systems of 2500 students or less can do much of their record-keeping with a microcomputer by using Microphys' new administrative software package.

The software runs on a 32K Commodore CBM computer with a 340K dual floppy disk drive and a compatible printer. It can handle up to 1500 student records at a time. With the addition of a one megabyte disk drive, the capability of the system increases to handle 2500 student records.

The package provides: (1) daily and cumulative student attendance reporting which can be annotated at any point before the final printing, (2) report card and end of term cumulative record production, (3) scheduling updates and class listings with class counts readily available at any time and (4) scoring and item analysis of all standardized objective tests.

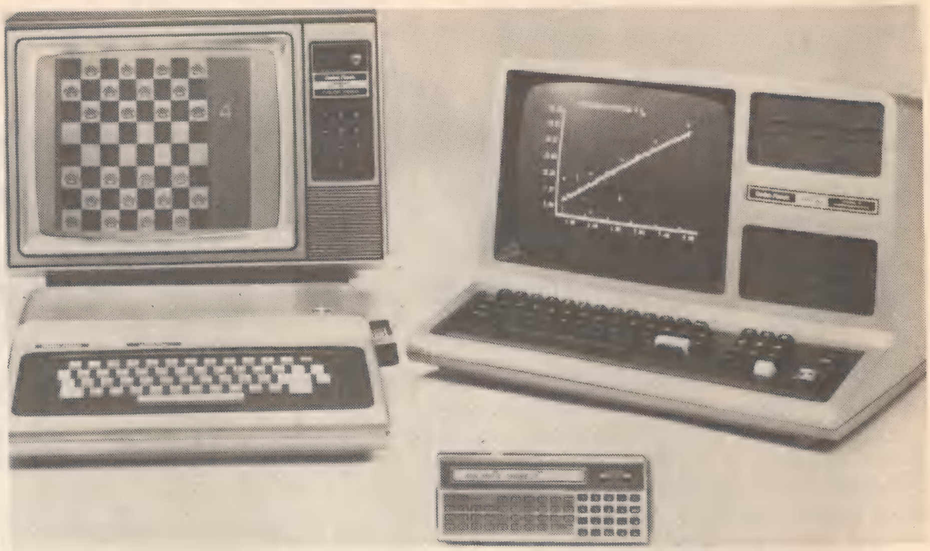
The software is modular so that schools can buy components separately. For more information, please write or call: Microphys, 2048 Ford St., Brooklyn, NY 11229; 212-646-0140.

About Time

Almanac, a new software disk for the Apple II computer, is appropriate for classroom instruction in geography, astronomy, geology and business applications regarding time. The extensively documented program package requires an Apple II with at least 32K RAM, Disk II and Applesoft II in ROM. A printer is optional.

Software functions include: printed calendar pages for any month, even prior to the Gregorian calendar reform, calculation of and from Julian day, and calculation of date of Easter; sidereal time, including a software sidereal clock for calculating star time; sunrise and sunset calculations; calculation of phases of the moon and of dates and times of solar and lunar eclipses; a high resolution graphics model of the solar system; a software real-time clock showing the time in time zones around the world, Greenwich Time and elapsed time in hours, minutes and seconds.

Almanac is sold as Software Disk A7 by Williamsville Publishing Company, P. O. Box 250, Fredonia, New York 14063.



New Deliveries from Radio Shack

Three new additions to the TRS-80 family of computers are among Radio Shack's 1981 offerings: a TRS-80 Model III, a pocket microcomputer and a color display computer.

The Model III offers more data storage, greater versatility and higher computing speed than the Model I. It features a more powerful BASIC and is available in 4K, 16K and 32K versions. The 16K version includes both upper and lower case letters and a real-time clock for control functions; the 32K version features two double-density disk drives with a total available storage capacity of 315K.

The pocket computer, although only six ounces and less than seven inches long, can do almost as much as the TRS-80 Model I. It is fully programmable in BASIC and has 1.9K of memory for user programs. It runs on four inexpensive, camera-type batteries and has an optional cassette interface. With the cassette, users can enter Radio Shack software and store their own.

The TRS-80 Color Computer includes: 4K RAM memory (expandable to 16K), 8K ROM color BASIC, RS-232C expansion port and built-in connection to any T. V. set. Users can also connect the system to modem, printer, joystick controls and cassette recorders. Plug-in, instant load Program Paks are also available.

For further information, contact your nearest Radio Shack Computer Store.

IDEAS from DEC

As a service to its systems users, Digital Equipment Corporation is publishing *An Index and Description of Educational Applications Software (IDEAS).*

IDEAS is a 350 page book containing descriptions of almost 500 administration and instruction applications software packages run on the PDP-11, PDP-8 and VAX 11/780 systems. It also includes a reference section listing similar software, ordering information and forms readers can use to submit software packages for inclusion in future issues. Users can obtain most of the packages described in *IDEAS* from Digital.

For a copy of *IDEAS*, write: Circulation Services, Digital Equipment Corporation, NR2/M15, 44 Whitney St., Northboro, MA 01132.

TI Offers New Learning Aids

Texas Instruments recently announced two new learning aids employing microprocessor, single-chip technology and synthesized speech.

One, called *Speak n' Math*, provides practice with basic arithmatic operations and word problems for grades one through six. Synthesized speech provides verbal reinforcement and directions.

The other learning aid, *Speak n' Read*, develops and reinforces basic reading skills. Children get practice with word families and sight word recognition. The "Hear It" activity allows them to hear what a word sounds like; "Letter Stumper" gives practice with auditory memory skills.

Speak n' Math and *Speak n' Read* are both available at retail stores. Plug in modules to expand the capabilities of the aids will be available later this year.

Texas Instruments' new *Math Marvel* reinforces basic math skills for students in grades one to six. The educational learning aid, and the accompanying booklet, "Math is Marvelous," provide the youngster with a wide range of learning games and activities to help develop basic skills in addition, subtraction, multiplication and division. Other TI educational products: *Speak n' Spell* and *Speak n' Math*.

Fun with the Sun

SUNMAX, a new computer game, can teach students about solar energy and geography. The computer assigns each of one to nine players both a city randomly selected from over 200 cities worldwide and a solar energy job such as home heating, hot water heating or home air conditioning. Each player, in turn, must guess the tilt (in degrees) of the solar collector that will maximize the amount of solar energy collected. After each guess, the player gets feedback on the latitude of the location, the amount his or her estimated angle was in error and the total amount of error on all turns combined. The lowest total error score wins.

SUNMAX is written in TRS-80 Level II BASIC and requires 16K of memory. It is available from Solartek, PO Box 298, Guilderland, NY 12084.

Software Report from DesignWare

Courseware Market Reports, a market survey for educators interested in obtaining and/or writing educational software for microcomputers, is available from DesignWare, inc. The report covers the history of computer-based education, computer languages and systems, currently available software, hardware and software suppliers, and marketing information. Write DesignWare, inc., PO Box 14664, San Francisco, CA 94114.

Musical Micro

Ohio Scientific's new Series 2 CIP microcomputer offers sound, music and voice output capability and a powerful resident BASIC. Its modem interface makes it an economical remote terminal for time-share services and enables users to hook into personal computer information services like The Source. It also has advanced floating point math capability. For further information, call Ohio Scientific toll free at 800-321-6850.

Atari Light Pen

New from Atari: The CX70 Light Pen allows users to paint multi-colored scenes on the screen, pick items from a menu, play games or direct geometric calculations simply by pressing the pen to the television screen. The light pen works by reading the coordinates of the TV electron beam. For further information, write or call: Atari Consumer Division, 1265 Borregas Avenue, PO Box 427, Sunnyvale, CA 94086; 408-745-2883.

We Want Your Words

Are you a teacher with strong ideas about how to use computers in the classroom?

Are you a librarian or media specialist who's developed a useful computer program?

Are you an administrator with something to say about purchasing, inservice training, security, maintenance or trends in educational computing?

Are you an educator with a nose for computer news?

If so, *Classroom Computer News* would like to publish your words.

In terms of content, we are interested in stories that help teachers and educators make better use of computers in the schools.

In terms of style, we are interested in news and feature stories that are fact filled, well-written and expressly directed toward our bright and critical readers. Stories should be lively, concrete and written for intelligent humans, with minimal use of computer or educational jargon.

News stories, as presented in the On Line section, run 300 to 400 words. Feature stories run from 800 to 2500 words. Clear, high-contrast glossy 8 x 10 photos are welcomed. Computer programs must be well-documented, thoroughly tested and machine printed. Use a new ribbon and clean white paper for program listings. Manuscripts should be typed and triple-spaced.

Classroom Computer News will pay $20 to $50 a printed page upon publication for reader-contributed stories, depending upon the quality of the manuscript and the amount of editing/rewriting needed. Contributors will also be given five copies of the issue containing their submission.

Send queries or manuscripts to Lloyd R. Prentice, Editor, *Classroom Computer News*, Box 266, Cambridge, MA 02138. Allow six weeks for acknowledgement. All submissions will be acknowledged, but only manuscripts accompanied by a self-addressed stamped envelope will be returned if not purchased.

BOOK REVIEWS

by Lenore Parker

Computer Applications in Reading

by George E. Mason and Jay S. Blanchard
International Reading Association

This pocket-sized soft-cover book may well be likened to a computer in its ability to compress a vast amount of information into a minute amount of space. The book, published last year, is chock full of fairly recent information about computer applications in reading.

It begins with a brief history of computers and a helpful explanation of computer-assisted instruction (CAI) and computer-managed instruction (CMI), important concepts for the educator to grasp. The following chapters unfold an orderly progression of facts and ideas starting with technical information about how computers work and continuing with descriptions of:

—computer-based reading programs developed in college centers

—public school applications of computers in reading instruction

—the use of computers in readability and textbook analysis

—sources of computer services

—recommended uses of computers in reading instruction

—the future of computers in reading.

The authors have included definitions and parenthetical explanations of unusual terms or acronyms. For example, we learn that BASIC, the well-known computer language, is an acronym for Beginner's All-purpose Symbolic Instruction Code. This technique is used throughout the book. Had the authors supplemented it with a glossary for ready reference on subsequent pages, they would have all but solved the reader's problem of struggling to retain an abundance of new facts.

The book reassuringly describes the teacher's role in working with current computer applications in reading instruction. Those who feel technology will replace humans can feel confident that the teacher's role is critical and always will be. Monitoring instruction, reviewing pupil progress, preparing teaching/learning prescriptions and writing computer programs are but a few of the tasks computers won't take over.

As for the degree to which computers are used for teaching reading, the authors felt, at the time of their writing that relatively little had been done. They feel that this will change, however, and highlight projects now underway. Their predictions are based not only on the constantly increasing needs of educators, but also on the forecast that most American homes will have microcomputers by 1990.

Though this may be unrealistic in light of inflation and educators' resistance to other media, the authors' optimism is based on realistic considerations of what can and should be done with this remarkable technology. They foresee such things as computer use in schools to relieve teachers of the tedium of the drill and practice lessons, continued and improved computer use for testing, diagnosing and prescribing, and a wedding of computers with books and TV in a multi-media approach to instruction.

All in all, the reader is treated to a wealth of information, an optimistic view of future computer uses in education, and, specifically in reading, the reassurance that the rapidly expanding need for computer software will lead companies to hire well-known educators as program writers. Considering the unending explosion of the computer world, chances are that these predictions are already becoming realities.

Dr. Lenore Parker is dean of the Department of Education and Communication, Lesley College Graduate School, Cambridge, Mass.

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SCIENCE AND EDUCATION

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Microphys, a leader in educational software design, is pleased to announce the development of an *administrative* software package that will provide, in a highly *cost-effective* and *efficient* fashion:

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2. Scheduling updates including the generation of *new class lists*, *student schedules* and *add-drop forms*. All section changes are recorded and true *class counts* and an up-to-date *school course directory* may be generated at any time. $1500 *
3. Complete *exam scoring* and detailed *item analysis* of all standardized objective tests. The same data base associated with the attendance and scheduling features is accessed by this system. A relatively inexpensive, though extremely reliable, *electronic mark-sense card reader* is a required component of the hardware package. $250 *
4. End of marking period report cards and cumulative school record production for each student. The generation of class rankings and honor roll search capability also exist. $2500 *
5. Production of mailing labels addressed to the parents/guardians of general or selected groups of students. Word-processing software, not produced by Microphys, is a recommended complement to the above administrative system. $250 *

* **Note:** The prices represent a *one-time* licensing fee. Special discounts are accorded multi-school districts.

The software is of *modular* design so that it is possible to contract for the attendance and scheduling-update features immediately, and then, at a later date, acquire the report card, mailing list, and exam analysis features.

The system is intended for use within a *microcomputer* environment consisting of a 32K Commodore CBM computer; a 340K dual floppy disk drive; and a compatible printer. This hardware configuration represents an investment of $3500. *Note:* Hardware should be obtained from and serviced by local Commodore dealers. Presently schools with approximately 1500 students may readily manage the administrative functions listed above. With the rather imminent introduction of the one megabyte disk drive, the maximum school population will increase to 3000 students.

Administrators and concerned school personnel are urged to write for additional details, sample print-outs, and a complete demonstration of the entire system. The financial savings and educational benefits to be accrued by the adoption of this system are tremendous and should be explored by virtually every school.

Sales representatives and dealers are invited to inquire about terms.

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Classroom Computer News

SEPTEMBER-OCTOBER, 1980

VOLUME 1, NO. 1

The educational computing industry is growing rapidly, but who has control?

The Computer Industry and Education: the Issue of Responsibility

by Phyllis Caputo

Computer manufacturers are zeroing in on the educational computing market. Executives of Texas Instruments, in a recent stockholders' meeting, singled out education as one of the four top markets for new Texas Instruments products. Charles Phillips, Radio Shack's senior vice president, says that "Radio Shack had determined that in the eighties, education will be our second largest market, second only to small business." Similarly, Commodore Business Machines estimates that 25-40 percent of their market will be education in 1981.

Present and projected sales figures for the education market alone reveal the reason for this increased interest. Of the 16,112 public school systems in America, 30 percent have computers for instructional use. In the next four years, this could increase to 60 percent of all schools. International Data Corporation, an independent market research and consulting firm for the information processing field, predicts that sales of microcomputers will increase five-fold in the next few years, reaching shipments of 1.2 million in 1983. School sales for that year are expected to be 105,000 units — a projected $146 million, up from $46 million in 1979.

These projections cross-check with assessments by industry officials who report a near doubling of growth each year. Industry spokespeople, while unwilling to give exact sales figures and dollar sales projections, do offer impressive ball park figures. Control Data (distributor of the PLATO computer learning system), for example, reported 1979 sales double those of 1978; 1980 promises

Please turn to pg. 6

NEWSBRIEFS

- Gulf Texas Multiregional Processing Center has recommended Bell & Howell microcomputers for region's 110 school districts. Officials expect recommendation to result in purchase of 600 systems during 1980-1981. It's the largest single regional purchase of microcomputers yet, according to Bell & Howell. The center serves 640,000 students, including the Houston Independent School District.
- Lesley College of Cambridge, Massachusetts, has developed a graduate program in computers and education. The program, which leads to a master's degree and a teaching certificate, includes courses in hardware, programming and curriculum development.
- The University of Minnesota and Control Data Corporation have announced plans for a Midwest regional center for microelectronics and information systems. Control Data contributed $2 million toward the center, one of the largest grants ever received by the university.
- Apple Computer Inc. plans soon to file with the Securities and Exchange Commission a public offering of common stock. Apple, started in a Palo Alto garage in 1977, is said to have annual sales of about $175 million. The company expects to raise more than $20 million.

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- Why you need a computer in your media center
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- Computers and the language arts
- A vocational arts teacher finds that a micro makes a difference
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